LEVANTINE-EGYPTIAN INTERACTIONS DURING THE 12th TO THE 15th DYNASTIES BASED ON THE PETROGRAPHY OF THE CANAANITE POTTERY FROM TELL EL-DABcA

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INTRODUCTION[1]

The nature of the interactions between Egypt and western Asia throughout the late fourth to the late second millennia BCE is one of the most discussed issues in the current literature on Egyptian archaeology. The ongoing excavations at Tell el-Dabca, the site of ancient Avaris, have put forward these discussions and the understanding of the entire sequence from the 12th dynasty Middle Kingdom (MK), through the 15th dynasty (Second Intermediate Period [SIP]), to the middle of the 18th dynasty (beginning of the New Kingdom [NK]) (BIETAK 1986; 1991a,b; 1996, 2000). The rich archaeological record from Egypt and the Levant coupled together with valuable, yet limited contemporary documents, provide evidences for Egypt's commercial and cultural contacts with the Levant throughout the entire sequence. However, they leave open many questions regarding the detailed social and economic aspects of Egypt's interests in various parts of the Levant. The evidence for imports of foreign goods, mainly Canaanite and Cypriote ceramic wares (and presumably their contents) are especially important since they enable good chrono-stratigraphical correlations between sites in Egypt and western Asia. Provenance studies of pottery assemblages have been used in the past in order to examine the nature of the Egyptian-Levantine interactions (*Cf.* GOLDBERG *et al.* 1986; PORAT 1989a; 1989b; GOREN 1991a, 1995; GOREN *et al.* 1995; COHEN-WEINBERGER 1997; BOURRIAU *et al.* 2001; PORAT and GOREN 2002; SERPICO *et al.* 2003; GOREN *et al.* 2004). These studies demonstrated that mineralogical and chemical examinations of ceramics may supply significant information about the origins of Egyptian and Canaanite wares. In the present paper, the results of a comprehensive petrographic study of the Canaanite pottery found in Tell el-Dabca are presented and discussed. The ceramic assemblage from this site comprises one of the largest collections of foreign vessels ever to be found in Egypt. A large number of vessels with Canaanite typology were found in various parts of the site, and it has been suggested that this pottery was imported from different regions of the Levant (BIETAK 1996; MCGOVERN 2000). The petrographic results enable us to observe changes in the trends of the trade relations during this chronological sequence and to discuss their implications on the political and historical modes during this entire time span.

METHOD

Over 300 petrographic thin sections of selected Canaanite vessels covering a broad range of types and fabrics from strata related to the 12th to the 15th dynasties in Tell el-Dabca[2] were used. These were examined under a petrographic (polarizing) microscope, following the general procedures and approach discussed by GOREN *et al.* (2004, 4–22) for asserting a geographic source (namely, geological formation and/or soils) for the materials in use. The samples consisted of many Canaanite amphorae (or storage jars). In addition, daily used domestic and prestige vessels were examined, including MB painted vessels and some Tell el Yahudiya juglets.[3] One hundred

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2 See BIETAK *et al.* 2001,172 for stratum division. More than 50 Canaanite examined vessels were found to be made in Egypt. Some of these vessels are included in Table 3 Appendix A, but will not be discussed in this paper.

3 Provenance study of Tell el Yahudiya ware from the Levant and Egypt is conducted by the authors.

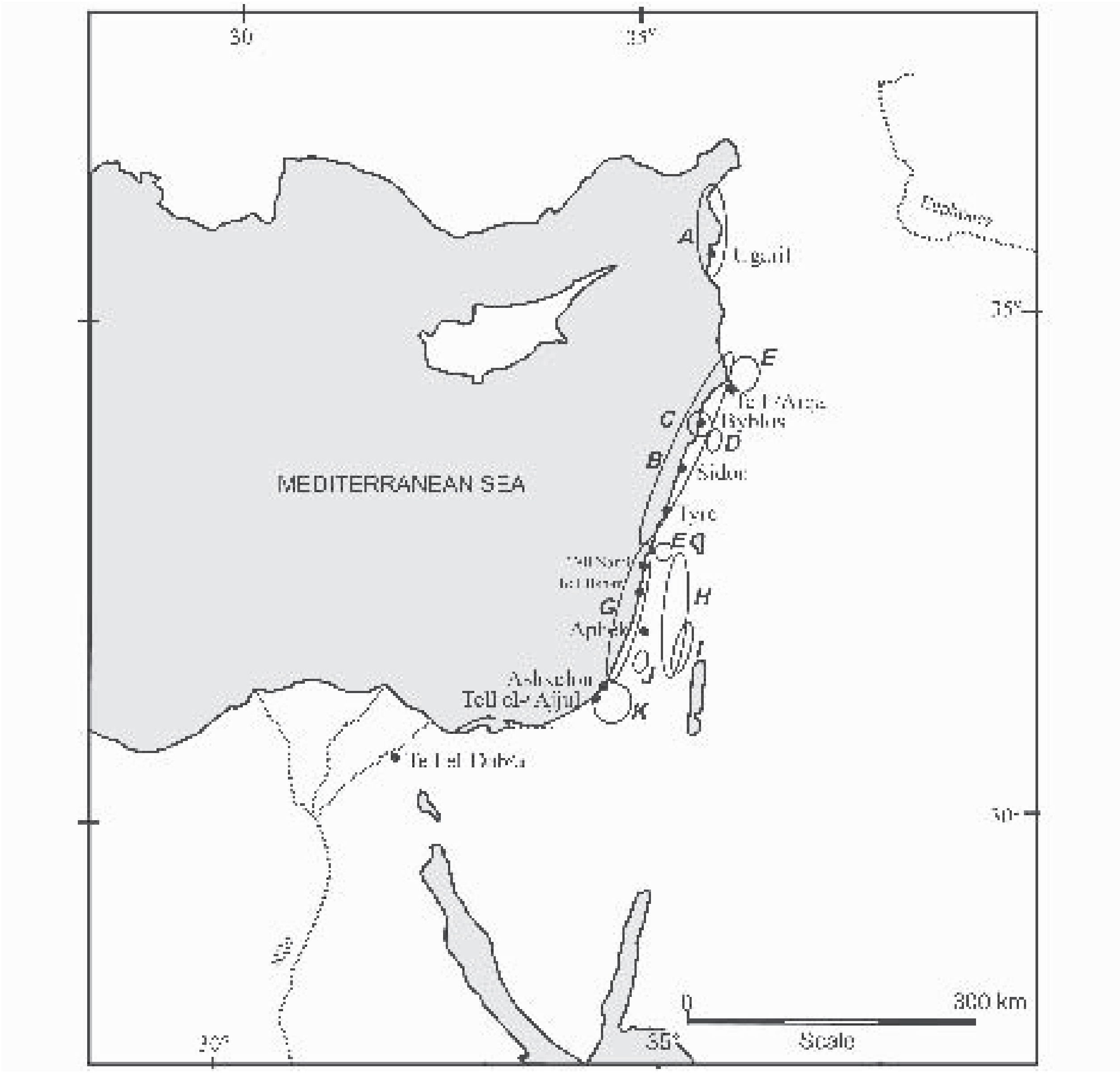

Fig. 1 Map showing MB sites in the Levant and the source areas of petrographic groups A–K

and thirty vessels were examined from stratum H (d/2), representing the end of the 12^{th} dynasty with overlapping to the 13^{th} dynasty and from strata G (d/1–c), representing the 13^{th} dynasty. The middle–late 13^{th} dynasty (or the 14^{th} dynasty based on the reconstruction of Canaanite pre-Hyksos dynasty in Tell el-Dab^{c}a) is represented by 53 samples, and the Hyksos 15^{th} dynasty is represented by 59 samples (Table 2). In addition 10 imported Canaanite vessels were examined from the 12^{th} dynasty strata e to b/2 in ^{c}Ezbet Rushdy. About one third of all samples were taken from vessels found in tombs, thus being complete or nearly complete. The sampled vessels from the settlement consist of large indicative pieces from a good context. As a test group, vessels from pit 40 in stratum d/1, including hundreds of finds, were intensively sampled. Table1, a–e provides the inventory of the examined Canaanite vessels, including their typology, archaeological context and petrographic results.

The petrographic analysis aims at classifying the samples into petrographic groups. A petrographic group includes samples of pottery that share similar petrographic properties of clay and temper. This classification is determined according to the qualities of the raw materials alone, regardless of the typology of the vessel, its chronological affinity and the geographic location of the site. Therefore, it serves as an independent method of classifying ceramic assemblages. The petrographic groups described below bear characteristics that can be attributed to a geological source and hence to a geographical origin. For each provenance determination reliability index between A and C based on size and quality of the samples was assigned as follows: A – the proposed origin is highly reliable; B – the proposed origin is fairly reliable and, hence, less reliable than A; C – the proposed origin is poorly reliable.

Petrographically, Egyptian pottery is readily identified by its typical pastes and may be easily discriminated from Canaanite wares (GOREN *et al.* 2004, 10–11, 15, 29–30 with references). The results of the detailed petrographic research of Egyptian pottery assemblages and the increasing data on Egyptian ceramic raw materials (*cf.* BOURRIAU and NICHOLSON 1992; ARNOLD and BOURRIAU 1993; ASTON *et al.* 1998; BOURRIAU *et al.* 2000) indicate a consistent continuity in the use of essentially two main classes of raw materials (Nile mud and various types of marl clays) throughout the periods. They also enable excellent differentiation between Canaanite and Egyptian materials. As for the Canaanite pottery, the situation is less clear, since the Canaanite potters had access to a greater variety of clay types and, therefore, Canaanite pottery tends to be far more composite in its raw materials than Egyptian wares. Yet the extensive database of pottery of all periods that we could access enabled us to overcome this shortcoming. For this end we used the petrographic thin-section collections and sources of information that are listed by GOREN *et al.* (2004). Our petrographic database includes reference raw materials and a collection of thin sections of pottery from most of the significant archaeological sites in the southern Levant. Additionally, collection of thin sections from many sites in Syria and Lebanon were studied in several other institutions.[4] Comparison of the present thin sections to these collections allows us to deduce the particular region in which clay artifacts were produced. In several cases, the deduced region is very specific and in other cases it is possible to deduce at least the general geological whereabouts from which the raw material of a ceramic artifact was derived.

RESULTS

The petrographic groups that are represented in the Tell el Dab^ca assemblages will be presented here to some detail, including their mineralogic and lithologic affinities, their likely geological setting and presumed provenance. The groups are arranged by their proposed provenance within the Levant from north to south. Table 2 presents the number of vessels related to each petrographic group according to their chronological phase. Figure 2 presents the provenance frequencies of all the examined vessels during the entire MK–SIP sequence.

Group A: Ophiolitic rock fragments

This group constitutes a few imported vessels along the chronological sequence in Tell el-Dab^ca. Pottery belonging to this group is charac-

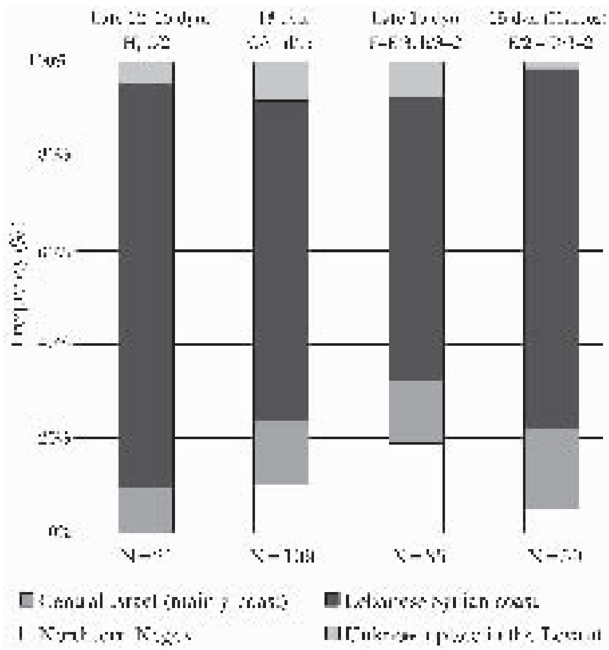

Fig. 2 Frequencies of vessel sources during the MK-SIP sequence. Each color exhibits a different provenance (see legend). Period and number of samples are indicated. Attribution of various strata to different dynasties follows Bietak's determination, and is mainly based on the Egyptian pottery from the various strata in Tell el-Dab^ca (BIETAK 1997:90, fig 4.3., 2002:31, fig.2)

[4] The following scholars kindly allowed us to use their reference collections of thin sections: L. Smith and J. Bourriau from the McDonald Institute of the Cambridge University, E. Bettles and D. Griffiths from the Institute of Archaeology, University College London, A. Middleton from the Department of Scientific Research of the British Museum. We would like to thank J-P. Thalmann, P. Parr and E. Cooper for their useful comments and as yet unpublished information.

terized by Micaceous, serpentine-rich, commonly isotropic matrix with a varied assembly of inclusions containing mafic minerals (of the pyroxene, olivine, serpentine and amphibole groups), volcanic rock fragments (commonly ophitic basalt) with occasional intrusive and plutonic basic to ultrabasic rock fragments. Also common in this group are fragments of radiolarian chert, often stained by iron minerals, limestone and schistous rock fragments (Pl.I:a, b).

The compositional, textural and mineralogical characteristics of this group indicate a source environment on the margin of an ophiolite complex. Ophiolites are presumed to represent oceanic crust, which has been thrust onto continental crust. When complete, an ophiolite sequence consists of a thin uppermost veneer of oceanic sediment (which may include oceanic clay and radiolarian cherts) overlying pillowed basalts and more mature lavas, which in turn overlie a sheeted dolerite complex. Beneath the dolerites are texturally isotropic gabbros, which overlie layered gabbros, peridotites and pyroxenites. These components are cut by late-stage intrusions of granite and overlay older oceanic sediments including radiolarites and limestone.

In the Eastern Mediterranean region, ophiolite complexes are found in Cilicia, northwestern Syria, Turkey, and Cyprus. They form the Troodos massif in southwestern Cyprus, the Mersin and Pozanti-Karsanti massifs in Cilicia, the Kizildaĝ massif in Hatay Province, Turkey, and the Baër-Bassit massif of northwest Syria north of Ugarit (Whitechurch *et al.* 1984). Radiolarites, which characterize the ophiolitic regions of northwestern Syria and the Hatay province, are absent from the Troodos ophiolitic complex in Cyprus. The very limited radiolarian shales that appear in the Mamonia complex of western Cyprus are different in nature from the ones described here, since they do not appear as chert (Gass *et al.* 1994). Radiolarites do not occur in other parts of the Levant as well. In the eastern Mediterranean zone, radiolarites may therefore be related with the ophiolitic complexes of the Kizildaĝ massif and the Baër-Bassit massif (Whitechurch *et al.* 1984, 306–307). Therefore, when radiolarian cherts appear as part of the inclusions, we assign this group to the northern Levant (Fig. 1, see also Goren *et al.* 2004, 57–62, 88–90 for more detailed discussion concerning the Alashiya and Ugarit letters).

To the north of Latheqieh, a layer of radiolarites is deposited on top of the dolerite of the ophiolitic complex (Dubertret 1955, 91–92). In the field, the radiolarites appear as jasper red, rose or brighter pink due to their staining by ferrous minerals. The latter are also seen in thin sections (*ibid*, pl. XVI, fig. 2). Alteration of radiolarites, mudstones, lavas and tuffs of basic or intermediate composition, limestones and flints characterize this unit, which is dated to the Late Triassic–Early Jurassic ages (Ponikarov 1964, sheets I-36-XXIV; I-37-XIX). This unit, which is part of the Baër-Bassit massif, appears in numerous locations north of Latheqieh through the Baër-Bassit massif to the Hatay province. Hence, the origin of this group is looked for in the area stretching from the Syrian coast north of Latheqieh to the Iskenderun Bay.

In the petrographic reference collection of Late Bronze Age ceramics from Ugarit at the McDonald Institute, Cambridge University, similar radiolarites form the common and most distinctive feature of the inclusion assemblage. The same applies for the Amarna tablets assigned to Ugarit (Goren *et al.* 2004). However, other candidates for the origin of this group can be found in the Amuq area. Matson (In Braidwood and Braidwood 1960) presents detailed petrographic data concerning the pottery assemblages of all stages at the Amuq Valley. Additional information was retrieved from our collection of about 100 representative thin sections of Amuq ware fabrics.[5] Serpentine with a wide range of basic and ultrabasic rock fragments and metamorphic facies characterize the ceramics of the Amuq sites. Another area which may be the origin of this group is the Cilician coast, where the Mersin ophiolite exposes northwest of the city of Mersin, under the Miocene and Oligocene conglomerate reworking of the ophiolite (Thierry 1980, 216).

In cases when radiolarian chert was absent, the vessels were more broadly attributed either to the northern Syrian, Cilician or Cypriot provenance. In such cases, the exact origin of the vessel could

[5] The thin sections were made from a systematic study collection prepared by Braidwood in the 1960's for the Israel Department of Antiquities.

be supported by typological considerations (namely, Cypriote versus Levantine typology). Consequently, we divided Group A into two subgroups: (1) *Group A1:* Ophiolitic, containing radiolarian chert. (2) *Group A2:* Ophiolitic, containing no radiolarian chert.

Group B: Rendzina soil, marl or alluvial clay with coastal bioclasts, chalk and chert

This group constitutes a significant amount of the imported Canaanite vessels. It appears with three clay types, but with the same inclusion set. The first clay type is a carbonatic clay with variable amount of Tertiary microfauna (Pl.I:f) and some glauconite concentrations. The second clay type is argillaceous and optically oriented clay (Pl.I:h) that often contains some mica laths in the silt. The third clay type is a ferruginous clay rich in silty carbonate. Both clay types were sometimes mixed with *Terra Rossa* soil, a common trait in Levantine ceramic technology. The inclusion assemblage often contains abundant chalk clasts, rounded fragments of bioclastic coastal limestone (beachrock), and fossils of coastal fauna and flora. The fossils consist predominantly of articulated fragments of the calcareous coralline alga *Amphiroa*, together with mollusk shell fragments (Pl.I:c, d). Chert, usually smoky to brown with local intergrowth of chalcedony (Pl.I:e), is also common as well as subrounded to subangular micritic limestone, subangular fragments of geode quartz with common inclusions, quartzolith and volcanic rock fragments. Members of this petrographic group often contain several components of the above "ingredients" in varying proportions, and are rarely contained the entire components. This inclusion assemblage forms a rather unique combination. The chalk fragments indicate that they were originated from rendzina soils, which are soils that formed on chalk bedrocks as a consequence of weathering under the Mediterranean climatic. The clays were often taken from reworked exposures, containing high proportions of assorted fragments of the mother rock.

In the Levantine coast coralline algae of the genus *Amphiroa* (Pl. I:d) occur in Quaternary bioclastic sediments of the Pleshet, Kurdane and Hefer formations of Israel (Buchbinder 1975; Almagor and Hall 1980; Sivan 1996). To the north, similar features are recorded from the contemporary beachrocks and sands on the Lebanese coast that are as yet unnamed (Sanlaville 1977, 161–177; Almagor and Hall 1980; Walley 1997). While in other localities this alga appears in older sediments, in the eastern Mediterranean it is absent even from the Miocene reefal formations and appears only from the Pleistocene and on (Buchbinder 1975). Therefore we suggest, on the basis of the dominance of this component within the inclusions, that the source of this group is in the Quaternary beach deposits along the Levantine coast.

Evidently, the alga fragments have no relation with the foraminifera that appear in the clay. While the coarser material is apparently beach sand, the planctonic foraminifera, which live in deep water, probably come from the chalk formations on which the rendzina soil developed. The other components represent different units within the Levantine lithostratigraphic section. Chert is almost always related with formations of Santonian-Campanian or Eocene age, and geode quartz is typical to the Cenomanian–Turonian age. The igneous mafic minerals (serpentine, olivine, pyroxene) and the volcanic rock fragments that appear as detrital but rather large grains can represent Pliocene-Pleistocene basalt flows, or earlier Lower Cretaceous basalts that are generally scarcer in extent.

In summary, the source of the materials should be in an area where exposures of chalk appear together with Pleistocene to recent beach deposits of mainly calcareous character, chert and occasional basalt exposures. While in the southern Levant the coastal sediments are dominated by quartzitic sand, which originally comes from the Nile, in the northern coast of Israel (from Akko northwards) this type of sand diminishes and the sediment becomes increasingly calcareous (Rohrlich and Goldsmith 1984,100; Nir 1989,12). Rounded quartz grains with fewer accessory feldspar and "heavy minerals", typical to the southern Levantine Quaternary coastal deposits (Nir 1985,507, Nir 1989,12), may or may not appear in this group but in case they occur they always form a secondary constituent.

A systematic examination of thin sections made from Holocene coastal sand from various localities along the Levantine coast indicates that quartz is the dominant component as far north as the Haifa Bay. At Bat-Galim in Haifa the sand is still dominated by quartz, but in Akko the beach sand is composed almost exclusively of carbonates. Even the sands that exist near the eolianites (resulting from the weathering of kurkar) are reported to contain below

10% quartz (SIVAN 1996, 155). This implication is very significant, because it indicates that our samples should be related *a priori* to the coastal area north of Akko (Fig.1). While in a sand sample from south of the Akko area where quartz is dominant, alga fragments are very rare and it is very unlikely to have even one of them in a standard thin section, from Akko northwards they form nearly 70% of the sand components. This situation exists also in Rosh HaNiqra. In Lebanon quartz may still appear as a minor component in the beach sand dunes, but near Tyre and at Shoueifat (slightly north to it) the sand is made essentially of carbonates, mostly from bioclasts (SANLAVILLE 1977, 162–164). Further north, the beach sand dwindles quickly and in Sidon it is virtually absent. Further north, beach sands appears again in the Akkar Plain (*Ibid*, 161). Therefore, coastal sediments that are dominated by calcareous bioclastic deposits are a clear attribute of the northernmost Israeli, Lebanese and Syrian coast at some localities. This general picture does not change until one reaches Latheqieh, where other attributes appear (see above, Group A).

Other components within the inclusion assemblage may limit the possibilities even MORE. As one goes north, the thick Senonian deposits of the Mishash Formation in Israel lessen and the greater majority of cherts can be linked directly with Eocene exposures. The chalk that is interbedded with this chert is probably the source for the rendzina soil that characterizes the clay of many items in this group. All these rock types are found predominantly between Tyre and Sidon, and again north of Tripoli. Small exposures exist also east of Akko. This limits the possible origin of this group to these regions only. When volcanic rock fragments appear, they can be linked to an inland area where volcanic rock types expose. The only area where Quaternary carbonatic beach deposits, Senonian or Eocene chert, and mafic minerals of volcanic origin may appear together is the northern Lebanese to Syrian coast between Tripoli and Tartous. The mafic minerals were most likely dragged there from the inland Akkar plain, where basaltic flows appear near Halba in the south and to the north of Nahr el-Kebir (SANLAVILLE 1977, 270–284, map 1). Therefore, the origin of vessels containing basaltic minerals should be looked for in the coastal area of the Akkar Plain. In conclusion, we assign the entire group to the general area of the Lebanese coastal plain. In cases where basaltic components are absent, the area of Tyre to Sidon seems to be a good candidate for the origin of the vessels. Petrographic studies of vessels from these sites proved that this was the common raw material there (BETTLES 2003; GRIFFITHS 2003a, b). When basalts appear, this source area becomes unlikely. However, basalt flows appear together with similar materials further north, along the Plain of Akkar. In fact, this subgroup is identical with a group of letters from Aziru of Amurru in the Amarna archive, ascribed to the city of Sumur that is identified with Tell Kazel in the Akkar Plain (GOREN *et al.* 2002b:200; GOREN *et al.* 2004: 103–116, concerning the Amurru letters from the Amarna archive).

As consequence of this situation, we divided Group B into the following subgroups:

Group B1: Containing chalk, limestone, chert, *Amphiroa* sp. algae clasts, beachrock and volcanic rock fragments or their derived minerals. The provenance is attributed to the northern Lebanese or Syrian coast.

Group B2: Similar to Group B1 but lacking the volcanic components. It can be attributed to the entire area between Akko in Israel and the Akkar on the Lebanese coast. When chert appears as a common inclusion, the possible provenance is limited to the area between Tyre and Sidon, and from Tripoli northwards.

Group B3: Similar to Group B2 but lacking the *Amphiroa* sp. algae. It is attributed broadly to the northern Levant.

Group C: Fine clay with quartz and marly shale inclusions

This group is seldom represented among the imported Canaanite ceramic assemblage from Tell el-Dab^ca. It is characterized by distinctive clay, ocher-yellow in thin section (Pl.I:i), optically active with strong striated optical orientation under the microscope. Few foraminifera appear in it together with opaque minerals. Abundant and dark red to nearly opaque hematite particles appear as rounded bodies. Calcite crystals and micritic calcitic bodies are rather common in the clay, while quartz silt, accompanied by very few plagioclase particles, is very scarce. The inclusions contain sparse minerals and rock fragments, including some chalk, rounded quartz grains, chert and marly shale fragments.

Petrographically, this group provides very little indications for its source area. However, in the petrographic study of the Amarna archive, it dominates the rather rich assemblage of letters sent by Rib-Haddi, the ruler of Byblos in the Lebanese coast (Goren *et al.* 2004). Since we have no other parallel for this group, we tend to suggest a coastal Lebanese provenance for it, but this proposal has to be taken with caution until it will be supported by further petrographic or chemical data.

Group D: The Lower Cretaceous shale suit

This group is well represented among the examined Canaanite vessels from Tell el-Dab^ca. It appears with two clay types. The first clay type is argillaceous, ferruginous, shale-rich clay, with relatively high content of typical ferruginous ooliths.[6] Some ooliths developed around quartz grains while others have no internal structure. In most of the cases, quartz sand is present usually as sub-spherical grains. These include coarse rounded quartz grains (derived from sand or weathered sandstone), sandstone grains (aggregates of spherical quartz grains cemented by carbonate and/or iron oxide matrix), siltstone, oolitic limestone, spheroids of iron oxide (sometimes with an internal concentric structure) and aggregates of such spheroids embedded in micritic limestone. Also present are grains of biogenetic or pellitic limestone. Other indicators of this group are diversified shale fragments, some of which are ferruginous while others tend to be more clayey (Pl.I:j). Pellets and volcanic tuff occasionally occur in some of these samples. The second clay type is carbonatic clay. It contains the same set of inclusions, including ooliths and diversified shale fragments and occasionally some marine coral fragments.

A large body of comparative data enables us to determine that in this case, the lithological sections of the Levantine Lower Cretaceous were used as a source for both clay and inclusions. These sections outcrop widely in the Lebanon Mountains and less frequently in the Anti-Lebanon and Hermon Mountains and also in the Transjordan between the southern Dead Sea and Wadi Zarqa. Small outcrops occur also in the eastern upper Galilee and in Wadi Malikh and Wadi Far^cah in eastern Samaria.[7] These sections are known as the Hatira Formation in Israel, and the Kurnub Group in Israel and Jordan. In Lebanon, the terms *Grès de Base* or C1 have been used since the fundamental mapping of Dubertret but recently the term Chouf Sandstone Formation was formalized (Walley 1997). Many of the attributes of Group D are unique to these formations. The ferruginous oolites for example, are characteristic of the Aptien deposits of Israel, Lebanon and Syria. This petrographic group has been discussed in detail in the literature.[8] The presence of volcanic tuff and weathered basalt fragments in the inclusions in a few examined samples may be explained by proximity of the clay source to an exposure of the Lower Cretaceous volcanic complex (termed in Israel as the Tayasir volcanics, or basalte crétacé in Lebanon). These layers are widely exposed in the Lebanon Mountains. Exposures occur also in Makhtesh Ramon in the Negev, in Wadi el-Malikh in the eastern Samaria and on the slopes of Mount Hermon (Mimran 1972, Sneh and Weinberger 2003). In Jordan, although continental and lacustrine Lower Cretaceous layers (Kurnub Group) outcrop widely, the lower, volcanic unit is found in the subsurface. Therefore, Lower Cretaceous volcanic rock fragments do not appear in Jordanian ceramics that belong to this group. Hence the Lebanon Mountains become the preferable source area. The distribution of the Lower Cretaceous sandstone, shale and volcanic units in Lebanon is limited to the area that broadly extends between Mount Hermon to the south and the Akkar Plain to the north (Dubertret 1962). A narrow strip of this formation exposes along the ridge from Marj Ayyun northwards. The largest exposure appears in the area between Zahle in the Beq^ca and Aaley on the western slopes of the ridge. In the Anti-Lebanon Mountains, a strip exposes between Rashiya el Fukhar and Zebedani. However, the volcanics appear significantly only in the Lebanon Mountains, north of the Beirouth-Zahle line. Consequently, we suggest that the origin of this group should be looked for in this general area. More specifically to our case and considering the general petrographic trend of the assem-

[6] Ooliths are spherical to elliptical bodies, 0.25 to 2.00 mm. in diameter, which have concentric or radial structures.

[7] Very limited (and irrelevant) outcrops appear also in the northeastern Negev craters and in Jebel Mgha^cra in northern Sinai.

[8] Relevant references appear in Porat 1989a,b; Goren 1992, 1995, 1996; Greenberg and Porat 1996.

blage in question, the origin of this group could be related with the Lower Cretaceous exposures (including outcrops of the basalte crétacé) that occur immediately east of the coast, between Beirouth and Byblos (Fig. 1). Noteworthy, from all outcrops of Lower Cretaceous rocks in the Levant, that in Lebanon are the most closest to the harbors of the Mediterranean coast.

Group E: Rendzina soil or marl with basaltic and calcareous inclusions

The abundance of this group among the imported Canaanite ceramic assemblage of Tell el-Dab^ca is less than 10% with minor variations along the chronological sequence. It is characterized by clay derived from rendzina soils or foraminiferous marl often composed of typical dense idiomorphic silty calcite crystals which tend to be spherical. The foraminifera are of Tertiary age. One variant is made of basaltic soil. The inclusions contain an assembly of rounded or nearly rounded rock and mineral fragments, including several types of calcareous rocks (limestone, chalk, travertine), various types of basalt, chert, and quartz grains and fragments of aquatic mollusk shells (Pl.I:k, l). From their shape and sorting it may be concluded that all these inclusions were derived from river sand. This sand was collected and sieved and then used as the non-plastic component. The occasional presence of recent (not fossilized) aquatic mollusk shells indicates an active stream where water is found during significant parts of the year.

A main feature of this group is the dominance of basaltic rock fragments and minerals, derived from alkali-olivine basalts. The olivine phenocrysts are altered into iddingsite. The basalt grains are different from the Lower Cretaceous basalt (see above, Group D), or the Upper Cretaceous volcanics (see below, Group F). These affinities are typical to the Neogene-Pleistocene volcanics of the Galilee in Israel (Oppenheim 1959, 1962) or the Golan and Bashan area (Mor 1973). Similar exposures appear in Nahr el Kebir and its opening to the Akkar Plain, where Pliocene argils and marl, Senonian chalk and marl and Cenomanian-Turonian calcareous formations are found (Ponikarov 1964, sheets I-36-XXIV; I-37-XIX; Sanlaville 1977, 25, 243–280, carte No. 1). Further north, exposures of younger basalts appear in the Middle Orontes basin north of Buheiret Qattinen (north of Tell Nebi Mend) (Ponikarov 1964, sheets I-36-XXIII; I-37-XIII). North to it lies the northern part of Jebel Zawiye and the northern boundary of the Ghab Valley, where Pliocene basaltic flows appear (Ponikarov 1964, sheets I-36-XXIV; I-37-XIX). In Jebel Zawiye, the basalts are capping Campanian clayey limestones and chert, Cenomanian and Turonian limestone and dolomite series, and border Pliocene continental deposits (clay, marl, limestone and sandstone).

This petrographic group is known to dominate ceramic assemblages of the Central Jordan valley (Goren 1992; Cohen-Weinberger 1998). In the Akkar Plain, it was recorded from the LB pottery from Tell ^cArqa (J.-P. Thalmann, personal communication, 2000). At this site the local potters preferred to use the local marl tempered with sand derived from the banks of Nahr el ^carqa. Due to the broadness of the area concerned, the origin is attributed to northern Israel, Lebanon and Syria. This broad proveneance can be limited when marl with typical dense idioMORphic silty calcite crystals which tend to be spherical and/or tertiary foraminifera appear together with inclusions of basalt and seldom dolerite. In that case, it is likely that the origin of the vessels is in the Akkar plain (Fig.1).

Group F: Rendzina with calcareous and volcanic tuff inclusions

This group constitutes a few vessels of the imported Canaanite ceramic assemblage from Tell el-Dab^ca. The clay is usually carbonatic, silty and foraminiferous, probably representing reworked rendzina soil. The silt is essentially quartzitic and calcitic. The inclusions include a mixture of sedimentary and pyroclastic rocks: chalk, sometimes accompanied by limestone and travertine, various volcanic tuffs (Pl:I:m) and more scarcely independent xenomorphic crystals of olivine, pyroxene and their alteration products.

The combination of rendzina soil mixed with badly sorted chalk and an assemblage of unique volcanic tuffs and their derived minerals reflects a very unique environment where calcareous sedimentary rocks appear together with volcanoclastic rocks. In the southern Levant, there are only few districts that may fit this scheme. Tuff, dykes, and basalts occur in the slopes of Mount Hermon, where Lower Cretaceous volcanics expose nearby Jurassic limestone formations containing fossil reefs. However, even regardless the archaeological considerations, the soil that forms the matrix that is probably collected nearby the tuff and limestone inclusions, hints at a much younger environment. In such case, the only possible location where these three components may possibly meet is Mount Carmel, the adjacent area of Umm el Fahm Hills, where Late Cretaceous volcanic activity took place (SASS 1957, 1968, 1980). In the Carmel area 12 pyroclastic volcanoes were identified. Their various parts are represented by a series of vent deposits including black and massive pyroclastics, proximal flanks with variegated pyroclastics, and distal flanks with yellow pyroclastics. Since the eruptions occurred in seawater environment, the pyroclastics deposited in a marine environment that effected their typical argillization processes. However, some of these occurrences contain also some exposures of massive basalts, sometimes xenomorphic, and volcanic bombs. This occurrence cannot be mistaken with any other volcanic occurrence in the southern Levant. Therefore, only the Mount Carmel and the Umm el Fahm area remain as possible candidates for the origin of this group (Fig.1).

The archaeological data testifies that only few sites within this general area could have functioned as Canaanite centers that could possibly supply goods in far-distance trade. The following sites may be considered:

Yokne^cam: The rather limited excavations at Yokne^cam have not yet revealed the nature and size of the MB Age city. The prominent tell, located on the opening of Nahal Yokne^cam into the Jezreel Valley, is located only two kilometers away from the Nahal Rakefet (Umm e-Zinnat) tuffs and basalts. Nahal Rakefet drains directly into Nahal Yokne^cam, therefore the pyroclastics are supplied immediately to the foot of the mound.

Tel Dor: Little of the BA settlement has been revealed. Its great size and location suggest a principal anchorage site at the Carmel coast.

Tel Nami: Not far from Dor lies the small harbor site of Tel Nami, where rich MB strata were excavated, indicating extensive maritime trade contacts (ARTZY 1995).

Tel Burga: This was a principal MBIIA city in the northeastern corner of the Sharon Plain.

Other sites: Additionally, agricultural sites in the hinterland of the above cities such as ^cEn Haggit (WOLFF 1997) and Tell Megadim (WOLFF 1998) may be considered too. However these sites cannot be regarded as candidates for a far-distance trade.

In terms of comparative ceramic materials from the Mount Carmel area, the available materials were from Tel Nami (MARCUS 1995, MARCUS and ARTZY 1995), Yokne^cam (E. Bozaglo, personal communication 2001), Tell Megadim (A. COHEN-WEINBERGER, as yet unpublished) and ^cEn Haggit (COHEN-WEINBERGER and WOLFF 2001). Similar petrofabrics were observed especially in the pottery of Yokne^cam, ^cEn Haggit and Tel Nami (GOREN *et al.* 2002a: 228–230).

Group G: Hamra soil with quartz and calcareous sand inclusions

The abundance of this group among the imported Canaanite ceramic assemblage of Tell el-Dab^ca is less than 10% along the tested chronological sequence. In this group, quartzitic sand of the southern Levantine coastal plain is mixed with ferruginous, fine clay. Fewer sand-sized grains of accessory minerals including mainly minerals of the feldspar, amphibole and pyroxene groups accompany the quartz sand. In several cases they are accompanied by calcite cemented quartzitic sandstone, locally termed "*kurkar*" (Pl.I:o). The nature of this group, together with its geographical distribution in Levantine sites, clearly point to a coastal origin. In this area, red to dark reddish-brown silts and sands appear as part of the Rehovot Formation (ISSAR 1968), and the related ^cEvron Member in northern Israel (SIVAN 1996, 107–110). It is most likely that this red soil, locally termed as *Hamra*, was used here, perhaps after some purification by dilution of the sand component. *Hamra* soil is spread along the Coastal Plain of Israel from the Ashdod area north. As mention before (with regard to Group B), coastal sand of the classification described here does not extend much beyond the Akko area in the northern coast of Israel. Therefore, this group should be related to the Coastal Plain of Israel, between Ashdod and Akko (Fig.1). However, we tend to eliminate the sites that appear north of the Mount Carmel for several sedimentological considerations. In sites located along the Carmel coast (Tel Nami, Dor) tuffs from Mount Carmel appear together with the coastal sand (Pl.I:n). As for the more northern exposures (around Akko), the Hamra of the ^cEvron Member is reported to contain only up to 10% quartz (SIVAN 1996, 155, with references). Indeed, some of our reference material (pottery wasters made of Hamra from Akko and the nearby site of Hurvat ^cUtza (GETZOV 1993), have similar or slightly higher proportions of quartz (up to 15%). However, in the Tell el Dab^ca samples quartz is dominant, indicating a more southern origin.

In terms of reference, Hamra-made, quartz-rich pottery is distributed in Israel in sites located mainly along the central Coastal Plain. Pottery produced of Hamra soil is known from some Chalcolithic assemblages of the central Coastal Plain (GOREN 1991b), and from EB–MBII assemblages at Palmahim.[9] In the MBII, this group dominates the ceramic assemblage of the cemetery at Rishon Le-Zion sands.[10] A MBII kiln sites containing vessels of this petrographic group was excavated near Yavneh Yam (SINGER-AVITZ and LEVY 1992, with petrography by GOREN) and at Tell Michal (GORZALCZANY and RAND 1999).[11] Large series of MBII kilns from the coastal plain of Israel are known (e.g., KLETTER and GORZALCZANY 2001:95–104). Thus we can suggest the origin of this pottery in sites along the central coast of Israel such as Ashdod, Tel Aphek, Tel Gerisa, Tel Hefer (Tell el Ifshar), Tel Zeror or many other relevant sites in this general area.

Group H: Terra Rossa with quartz and/or calcareous sand inclusions

This group is hardly represented among the Tell el-Dab^ca pottery assemblage. It is easily defined even when examined merely by the naked eye. It is usually characterised by its dark reddish-brown colour, often with a darker core, and a silty appearance that can be observed with a magnifying glass or stereomicroscope. Under the petrographic microscope, it appears as a silty, non-carbonatic, rather ferruginous matrix (Pl.I:p) that commonly exhibits isotropic properties. This is probably due to the high iron content that acts as flux, decreasing the sintering point of the clay body to lower firing temperatures. The inclusions, usually limestone, chert and quartz in differing proportions, are sometimes accompanied by vegetal matter, i.e. straw.

This group is identified as *Terra Rossa* soil, mixed with sieved wadi sand. *Terra Rossa* is widely exposed over the mountainous regions within the Mediterranean climatic zones of the Levant, where it develops on dolomite and limestone rocks (WIEDER and ADAN-BAYEWITZ 2002:395–397). In Israel it appears in broad areas including the Judean-Samarian hills, Mount Carmel and the Galilee (Fig.1). Therefore, the provenance of vessels belonging to this petrographic group cannot be determined on the basis of their clay matrix alone. The reference material from Levantine sites, however, together with the inclusions that appear in some of the samples, may indicate a more specific provenance.

The inclusions in the samples contain mainly quartz and few chert. This indicates that the sands were collected in wadies that drain areas where either Senonian or Eocene chert formations are exposed, since these are the two major ages when chert was deposited in the Levant. The quartz, accompanied by rarer feldspars, is probably coastal sand that was swept inland by aeolian deposition. The combination of *Terra Rossa* and Senonian or Eocene chalk and chert formations strongly suggests the upper Shephelah or the Judean hills as the possible origin of this group. *Terra Rossa* soil, mixed with wadi sand, crushed calcite crystals or grog, was frequently used by Iron Age potters in Judea as a ceramic raw material, especially for the production of cooking-pots. In Jerusalem, the City of David excavations produced numerous ceramic figurines, most of which were made locally from *Terra Rossa* soil (GOREN *et al.* 1996). Relevant to the case are the royal (*lmlk*) storage jar handles, in which 180 examples were examined by NAA (MOMMSEN *et al.* 1984). The results suggest that the storage jars bearing these handles were produced at a single site, perhaps in the Shephelah. In the most recent petrographic study of these vessels,[12] it has been shown that the paste was made of *Terra Rossa* soil with chalk, quartz and chert temper. Hence, the few samples from Tell el-Dab^ca is attributed to this group and can be linked to the region of the upper Shephelah.

Group I: Dolomitic marl/clay with mostly calcareous sand

This group is hardly represented among the imported ceramic assemblage from Tell el-Dab^ca. The clay of this group is easily distinguished by its petrographic properties. The matrix is rich in

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9 Examined by the authors, as yet unpublished.

10 Examined by the authors, as yet unpublished.

11 The petrographic analysis was made by GORZALCZANY (personal communication).

12 Carried out by Y. Goren and S. Bunimovitz as yet unpublished.

tiny (below 50 µm) rhombohedral dolomite crystals, perhaps altered into calcite in the firing process, which can be identified only under the microscope. Except for the dolomite rhombs (Pl.I:q), this dolomitic marl contains tiny nodules of ore minerals. Under oxidizing firing conditions the clay matrix is burnt into light pinkish colors. The clay is accompanied by sand-sized calcareous and siliceous inclusions. The grains are usualy rounded, indicating their mechanical weathering by rolling. This sand originates in deposits of wadies which drain an area dominated by micritic and sparitic limestones, dolomite, chalk and chert. Quartzite and chalcedony particles are also characteristic of this assembly. Some of the samples contain fragments of fossils or grains of biogenetic limestone. The lithic assemblage represented in this group points to a geological environment which is dominated by marl, a series of verified limestones and lesser dolomites, with occasional quartzite nodules and chert. Such an assemblage agrees with the Moza marl, and the limestone and dolomite formations that are exposed in vast areas on the Judean-Samarian hills of Israel (Fig.1). The Moza marl, located underneath the clay unit of Moza Formation, contains about 18% of carbonate minerals compared to about 4% in the higher clay unit (BENTOR 1966, 48). Being the sole significant clay/marl formation in this region, it had been used extensively for the aim of pottery production. This group is well documented from several previous studies (GOREN 1995, and references therein). It is distributed mostly in sites located along the Judean-Samarian mountains.

Group J: Calcareous clay with fine quartz inclusions

This group is hardly represented among the pottery assemblage from Tell el-Dabᶜa. This group is characterized by highly calcareous clay, rich in foraminifera often oxidize. The microfauna assemblage within the matrix, when identified, is usually of Paleocene-Eocene age. The matrix is rich in fine, fibrous carbonate crystals and sometimes exhibits a weak optical orientation (length fast). The non-plastic components are mainly well-sorted fine quartz grains (Pl.I:r) and rarely chert fragments or crushed calcite. This raw material is identified as marl of the Taqiye Formation of the Paleocene age (BENTOR 1966:72–73). The distribution of the Taqiye Formation is widespread. It is exposed in the northern and central Negev, in the Jordan Desert, along the western slopes of the Judean hills, along Wadi ᶜAra, the central Jordan Valley, the Beqaᶜ Valley in Lebanon and some areas along the Mediterranean coast of Lebanon. The abundant inclusions of quartz grains indicate an aeolian contribution from the coast. The outcrops of the Taqiye Formation in the Shephelah, located in a short distance from the coastal sands, are the likely origin of the raw material observed (Fig.1). This assemblage was observed in the Amarna tablets from Gezer (GOREN *et al.* 2004).

Group K: Loess and quartz and/or calcareous sand inclusions

The abundance of this group among the imported Canaanite ceramic assemblage from Tell el-Dabᶜa is changed along the chronological sequence between 5–20%. The matrix is silty and rather carbonatic (Pl.I:s). The silt is well sorted and contains mainly quartz but also a recognizable quantity of other minerals including hornblende, zircon, mica minerals, feldspars, tourmaline, augite, and more rarely garnet, epidote, and rutile. Ore minerals are abundant too in this fraction. The non-plastic assemblage includes dense, well-sorted, rounded sand-sized quartz grains with the occasional addition of feldspars, hornblende, zircon, and augite (Pl.I:s). In several cases they are accompanied by calcite cemented quartzitic sandstone ("*kurkar*"). In other cases the inclusions are rich in limestone, chalk or both.

Based on a bulk of published data (PORAT 1987, 112–115; 1989a, 50–52; GOREN 1987; 1988; 1991a, 101–104; 1996; GOREN and GILEAD 1987; GILEAD and GOREN 1989, 7; GOLDBERG *et al.* 1986; ROGNON *et al.* 1987) the matrix is readily identified as *loess* soil. This type of soil occurs in the Levant mainly in the northern Negev and the southern Shephelah regions. We note, that by using the term "loess" we refer to a set of aeolian and alluvial silty-clay sediments that occur in the northern Negev and the Shephelah (RABIKOVITZ 1981, 341–386) and cannot be differentiate petrographically. Our comparative database from Levantine sites indicates that the overall distribution of sites that doubtlessly produced pottery of the loess soil does not extend significantly beyond the limits of the northern Negev – southern Shephelah regions. The Loess-made pottery had been produced in the rectangle area formed between Lachish, Ashkelon, Gaza and Beer-Sheva in any of the periods between the Pottery Neolithic and Medieval Ages (Fig.1).

In pottery assemblages that belong to this group, the inclusions accompanying the loess matrix are variable and indicate different geological environments. Consequently, they could be correlated with exposed outcrops of sands (GILEAD and GOREN 1989, fig. 2; GOREN 1991a, 118–120, fig. 13; 1995, figs. 3–8). Inclusions of limestone are prevalent mainly at sites located northeast to the Beer-Sheva Valley and the southern Shephelah. In the inner southern Shephelah region, inclusions of chalk are dominant and are even the sole non-plastic component. In the northwestern Negev sites, quartz is the major constituent (GILEAD and GOREN 1989, fig. 2). In addition, fresh fragments of marine mollusk shells, and the *kurkar* fragments which are attributed to the Pleshet Formation appear in that region as well (ISSAR 1961).

In summary, this group characterized the southern Palestinian wares. It originate at sites such as Gaza, Tell el cAjjul, Ashkelon and Ashdod on the coast, Tel Jemmeh, Tel Farcah South, Tel Haror, Tell Hesi and Lachish, as well as several other sites.

In Summary, Group A is related to the northern Syrian coast; Groups B is attributed to the Lebanese or northernmost Israeli coastal areas; Group C is related to the area of Byblos; Group D is related to the area east of the coast between Beirouth to Byblos in Lebanon; Groups E is related to the Akkar Plain in Lebanon; Group F is related to the Carmel region in Israel; Groups G is related to the central coast of Israel between Ashdod and the Carmel coast; Group H is related to one of the mountainous regions within the Mediterranean climatic zones of the Levant; Group I is from the Judea or Samaria hills; Group J is from the Shephelah region in Israel; and Group K is from the Negev coastal plain or the southern Shephelah (Fig.1).

Interpretation of the Petrographic Results

Below, we analyze in details the origin of pottery for each period separately.

The Middle Kingdom

The 12th dynasty – Strata e/3–b in cEzbet Rushdy

This phase is characterized by purely Egyptian culture of pre Asiatic period. Ten Canaanite vessels of the 12th dynasty from cEzbet Rushdy were petrographically investigated. In the cEzbet Rushdy excavations no complete MB vessels were found and the total number of MB shapes is small (BAGH 1998, 45). The samples include fragments of Canaanite jars and some MB painted sherds (BAGH 2000, 146). Four vessels of them were made in the northern Levant, but the exact region is unknown, and two vessels were imported from the northernmost Syrian coast (the region of Ugarit). Based on the petrographic assemblage, Cyprus is also a possible source for these two vessels, but this provenance is unlikely because Egypt was in occasional, perhaps indirect, contact with Cyprus from the late MK onwards (BIETAK and HEIN 2001, 171). One vessel was imported from northern Lebanon (Akkar plain), another vessel from the Carmel region in Israel, and one or two vessels were imported from the northwestern Negev. The limited number of imported vessels in these strata hampers defining conclusive trends of interactions. Although, the provenance of the MB painted sherds cannot be precisely determined, it is likely that they were produced somewhere in the northern Levant. The imported Canaanite jars were manufactured in several locations in the Levant.

The late 12th and the 13th dynasties – strata H–G in area A and strata d/2–c in area F

These strata are characterized by large amount of Canaanite shapes. Between 20–40% of the ceramic assemblage from the settlement layers consist of MB types and almost all of the tombs' pottery consists of MB types (BIETAK 1991b:32–38). With the exception of the imported "Canaanite jars," many of the MBIIA types found at Tell el-Dabca are made by local potters of Nile sediments. Hence, the actual percentage of the imported pottery is much lower than the percentage of the total Canaanite shapes (ASTON 2002, 41).

From these strata, 130 vessels were petrographically examined. About 30 samples were found in tombs, and more than 50 samples were found in pit 40, which is a huge pit filled with Egyptian and Canaanite pottery located in the palace garden in Area F/I of stratum G/4. Vessels that were produced in the northern Levantine coast (from Akko northward along the Lebanese and Syrian coast up to Ugarit, namely groups A–E) constitute more than 70% of the examined vessels (Fig. 2). Noticeably, similar percentages were calculated separately for vessels from the tombs and from pit 40. Moreover, analyzing the daily used vessels alone also indicates that about 80% of the imports are from the northern Levant.

These results strongly suggest a representative sampling. About 20% of the analyzed vessels were imported from the southern Levant (groups F, G and K) (Fig. 2). Two main differences are seen between the late 12th–beginning of 13th dynasties strata and that of the middle 13th dynasty: 1) loess made vessels appear in Tell el Dab^ca only in the middle 13th dynasty (Fig. 2), and 2) imported vessels from the region between Beirouth and Byblos (Group D) are minor in quantity (10%) in the 12th–13th dynasties and become prominent (30%) only during the middle 13th dynasty (Table 2).

The late 13th (or 14th) dynasty – strata F–E/3 in area A and b/3–b/2 in area F

These strata are characterized by an upsurge in Asian cultural and religious traits (BIETAK 1997:109). Stratum F is transitional MBIIA–B with MBIIA shapes still prevailing (BIETAK 2002:37, FORSTNER-MÜLLER 2002:163). About 50 samples from this phase were petrographically examined, nineteen of which were found in tombs. The vessels that belong to groups A–E constitute about 60% of the total. About 30% of the imported analyzed vessels originate from the southern Levant (groups F, G, H, I, and K) while almost 20% of the total are from the northwestern Negev (Group K) (Fig 2).

Painted Canaanite wares from the MK strata

Jugs and jars, decorated with simple red and black designs of horizontal bands from the excavations of cEzbet Rushdy (dated to the 12th Dynasty) provide the earliest stratigraphical positive evidence for Egyptian-Levantine contacts (BAGH 1998). TUBB (1983:53) and BAGH (2000) defined this class of decorated pottery as well as the more elaborate types as Levantine Painted Ware (LPW) (see TUBB 1983, ILAN 1996 and BAGH 1998 for definition and distribution of this ware).
Three petrographically examined samples of decorated sherds from cEzbet Rushdy were most likely imported from the northern Levant. Of the late 12th–13th dynasties, 11 decorated vessels were examined, seven of which ware most likely imported from the northern Levantine coast from Akko to Ugarit (Table 1b). Three other samples were probably imported from the northern Levant and the provenance of one more sample is unknown. Out of these eleven samples, two bear more elaborate painted design. One vessel (Table 1b:9, late 12th–13th dynasty) is painted with bichrome bands zone below and above a set of concentric circles. This item was produced in the northern Israeli or the Lebanese coast. The second (Table 1b:8) is decorated by criss-cross decoration and was most likely produced in the northern Levant.[13]

Second Intermediate Period

The 15th dynasty strata E/2–D/2 in area A and b/1 in area F

The beginning of the Hyksos Period (15th dynasty) was assign to stratum E/2 (BIETAK *et al.* 2001).[14] The amount of the imported Canaanite wares reduced significantly during this phase (Karin Kopetzky, personal communication 2002). Examination of the MB types from this phase by the naked eye shows that most of the Canaanite shapes are locally made of Nile Sediments, and hybridization of shapes (Canaanite-Egyptian) appear as well. Fifty nine samples from this phase were examined petrographically, sixteen of which were found in tombs. Groups A–E constitute about 75% of the examined vessels. During this phase, imported Canaanite vessels from the southern Levant (groups F, G, H, I and K) constitute about 20%, while about 5% of them are from the northwestern Negev (Group K) (Fig. 2).

SUMMARY OF RESULTS

The main conclusion that may be drawn from the present study is that the northern Levant had a pivotal role in the commerce layout of Tell el-Dabca along the entire chronological sequence (Fig. 2). The results suggest the following trends along the sequence: During the MK, when Tell el-Dabca was under the control of 12th and 13th dynasties, extensive maritime trade was conducted with the northern Levant. The imported vessels came first and foremost (over 70%) from the northern Levant, mainly from the northern Israeli, Lebanese and Syrian coastal area. The import from the southern Levant constitutes about 20% and that from the northwestern Negev

13 The authors are conducting a provenance study of the painted MB pottery from Ras Shamra, Kabri, Megadim, Tel Hefer, Aphek and other sites.

14 WEINSTEIN challenged this position (WEINSTEIN 1992, 1995).

constitutes less than 10% out of the imported vessels. During the late 13th dynasty, the amount of the imported vessels from the northern Levant slightly decreased, but still remained dominant (about 60%). The import from the southern Levant increased in general (about 30%), particularly from the northwestern Negev (almost 20%). During the 15th dynasty, the import from the northern Levant increased again to make more than 75% of the vessels. The imported vessels from the northwestern Negev decreased significantly (to 5%) as well as that from the southern Levant (to about 20 %).

The import from the northern Levant is petrographically divided into groups A–E. Group B constitutes the main component of the imported vessels from this area all along the chronological sequence (50–80%), Group C is very rare, while groups A and E represent about 5–10% each out of the imported vessels from the northern Levantine coast. The percentage of group D increased from 10% to 30% from the 12th–13th dynasties strata to the 13th dynasty strata and then gradually decreased through the late 13th dynasty to the 15th dynasty (Table 2, Fig. 3).

The results were marked from A to C according to their degree of reliability. To some of the examined vessels from the early–late 13th dynasty C reliability index was ascribed. These vessels are not from the Northwestern Negev, but were originated somewhere in central Israel or northwards in Lebanon and Syria. These vessels may deviate the above indicated percentages by no MORE than 10%. The vessels of unclassified origin constitute about 8%. These were most probably produced in the same areas and can also somewhat bias the overall results.

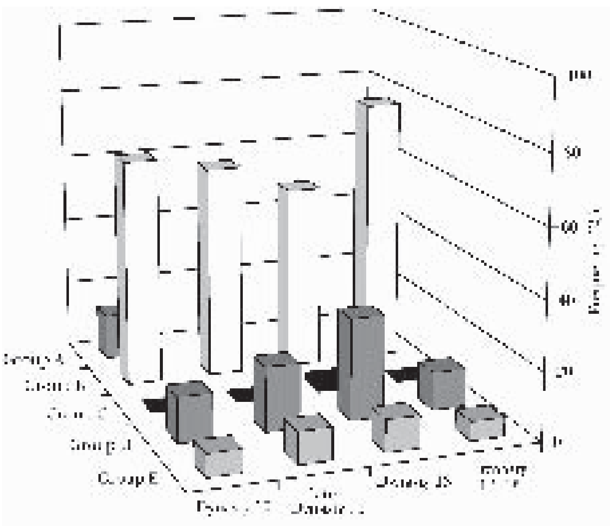

Fig. 3 Frequencies of northern Levant petrographic groups during the MK-SIP. See Fig.1 for source areas of petrographic groups

DISCUSSION

The Middle Kingdom

Our study indicates that already in the earlier strata of Tell el Dab^{c}a some of the Canaanite shapes were locally made.[15] This result is in agreement with a scene seen in the tomb of Khnumhotep III in Beni Hasan from the time of Senwosret II, representing a potter producing vessels, one of which looks like a handled Canaanite piriform or dipper juglet. Similarly, in the scene of the workshop in the tomb of Amenemhat in Beni Hasan, dating to the time of Senwosret I, some Canaanite-styled vessels are seen as well (NEWBERRY 1893, part I, pl. 29 and II, ARNOLD *et al.* 1993:48). The phenomenon of locally-made Canaanite vessels is beyond the scope of this paper. In what follows, we discuss some implications and aspects of the study related to the imported vessels.

The present results augmented the preliminary impression of the archaeologists, who had examined the pottery from Tell el-Dab^{c}a, that the vessels of the MK are imported first and foremost from the northern Levant (BIETAK 1996). This hypothesis shifted in the coarse of time due to the results of chemical analyses by Neutron Activation Analysis (NAA). These results were obtained from a large number of vessels, particularly the Canaanite jars (MCGOVERN and HARBOTTLE 1997; MCGOVERN 2000), and suggested that the lion's part of the vessels were imports from southern Palestine. The adoption of this conclusion inspired scholars to suggest some sweeping hypotheses regarding the nature of the interactions between Egypt and the Levant along the sequence (e.g., BIETAK 1996; MCGOVERN and HARBOTTLE 1997). For detailed comparison between the present results and the earlier NAA results see appendix A.

[15] Some of the locally made Canaanite shapes from the whole chronological sequence are included in Table 3 Appendix A. see note 3.

The high amount of imports from the northern Levant during the late 12th to the beginning of the 13th dynasties (strata H and G) might be expected, because at that period Tell el-Dabca was still under MK control, which supported its growth as a maritime port (BIETAK 1989:12; BIETAK 1996:20). The close commercial and diplomatic relations between MK Egypt and Byblos are well documented by archaeological and textual evidence (RYHOLT 1997:86–90). Undoubtedly, the gloomy situation of the Lebanese archaeology is responsible of the lack of significant information about Byblos and overshadows on the importance and the prosperity of other Lebanese cities (WARD 1994, 66–84).

The present petrographic results indicate that the southern Levant had a secondary role in Egyptian commerce during the 12th–13th dynasties. While the international maritime traffic in the eastern Mediterranean may have had a strong influence on the initial development of MBIIA Canaan (MARCUS 1998:223–224), Canaan's foreign contacts were probably quite minimal. The kings of the 12th–13th dynasties were probably more concerned about exploiting the wealth of the northern Levant, than trading with the undeveloped and most likely inconsequential settlements in the southern Levant. Indeed, the archaeological data that emerged during the last decade about the MBIIA of the southern Levantine coast reveal only a few indications for MK Egyptian connections (ARTZY 1995, Paley and PORAT 1997, LEVY 1993). The most significant Egyptian ceramic import to southern Canaan is the jar that was unearthed in Tel Ifshar (Hefer). It is dated by its typology to the first half of the nineteenth century BC, corresponding to the reign of the 12th dynasty kings Senwosert II or III (Paley and PORATh 1997). the presence of this jar in Tel Ifshar may indicate that in the MBIIA Canaan begun to take part, yet in a margined degree, in the international maritime traffic moving up and down the Levantine coast.

During the 13th dynasty, Ashkelon served as an important harbor in the southern Levant thanks to its location halfway between the Nile Delta and the northern Levantine coast. The recent excavations in Ashkelon reflect a strong Egyptian influence or even an Egyptian administration, as evidenced by the discovery of over 40 locally made bullae stamped by royal Egyptian seals of the 12th–13th dynasties (STAGER 2002:353).[16] In this stage in Ashkelon, (between Phases XIV and XIII, which is contemporaneous with stratum G/4 in Tell el-Dabca, see BIETAK 2002:41, fig. 15, STAGER 2002:359), imported pithoi from the Lebanese coast were found.[17] Nevertheless, while the latter are quite common in Ashkelon, only one example of them was found in Tell el-Dabca (Karin Kopetzky, personal communication 2002). Noteworthy, pottery made of loess, which was the common raw material used in Ashkelon, starts to appear in Tell el-Dabca in stratum G, which is contemporaneous with the earliest MB Age occupation phase in Ashkelon.

In stratum H (late 12th to beginning of 13th dynasty) the import of vessels made of loess from the northwestern Negev in Israel (Group K) constitutes negligible part of the assemblage, and then it gradually increases in stratum G (13th dynasty) to 10% of the imports. The loess-made imported vessels have a peak period during the late 13th dynasty (about 20%). During the Hyksos period it slightly decreases.

Second Intermediate Period

The present petrographic results indicate that the maritime trade with the northern Levant kept flourishing during the late phase of the 13th dynasty and the 15th dynasty. While the traded vessels from the Beiruth-Byblos region (Group D) declined during the late 13th dynasty (Table 2, Fig.3), vessels from the area between Akko to Sidon are still well represented. Sites such as Tyre and Sidon, with access to wood, oils and other exploitable cash crops, could easily have served a similar role as Byblos in the MK. The present conclusion is in agreement with the Kamose stela attesting that maritime trade kept flourishing during the Hyksos period. On the other hand, BIETAK and his colleagues argue that southern Canaan was the main or even the sole exporter of MB shapes to Egypt as early as the late 13th dynasty and during the Hyksos period (BIETAK 1996:35,59; 2000:92, KOPETZKY 2002:244). This view is also adopted by BEN-TOR

[16] The seal impressions were petrographically analyzed by the authors.

[17] A study of the provenance of the pottery and the seal impression is conducted by the authors.

(2003:246), who argues that during the late 13th dynasty (end of the 18th century and the beginning of the 17th century, stratum F or b/3 in Tell el-Dabᶜa) the traditional commercial contacts with the northern Levantine coast ceased to exist, and close relationships between the Hyksos settler of the Nile delta and southern Canaan began (Ben-Tor 2003: 246). This view is based on the lack of scarabs from this period in Byblos (Ben-Tor 2003:246. n.20). Apparently, the Admonations of Ipu-Wer bemoans that ships did not sail to Byblos during the Second Intermediate Period support the above view (Lichtheim 1973:149–50, Parkinson 1991:60). The finds from Byblos excavations provide negligible evidence for any relation with Egypt during the late 13th dynasty (Bagh 2000: 108; Lilyquist 1993:42–44, Tufnell 1969:16, nos. 59–60). The ongoing modern excavations along the Lebanese and Syrian coast such as Tell ᶜArqa and Sidon may shed light on the conclusions derived in this study, namely, the continuity of significant relations between Egypt and the northern Levant during the late 13th–15th dynasties.

One of the petrographically analyzed Canaanite jars from Stratum D/3–2 (Table 1e: 7), has a seal impression on its handle, bearing the inscription: *h3ty-ʿ šimw* (Bietak 1996, 60, fig. 51, pl. 25). The title *h3ty-ʿ* had an administrative connotation, meaning mayor or prince. The Byblian princes during the MBIIA seemingly adopted the Egyptian hieroglyphs and the Egyptian title *h3ty-ʿ*. The title *h3ty-ʿ* outside Egypt was also found on objects from other Levantine sites, including Kamid el-Loz, Tartous, and Alalakh (Ward 1961, 134–135; Teissier 1990, 68, n.7–8; Martin 1971; Malek 1996, 173; Bietak 1996, 60). The names of some Byblian rulers of the MBIIA are known from inscribed objects from Byblos and a reconstruction of the Byblian king list was suggested (Albright 1964, 38–46, 1965, 38–43, Kitchen 1967, 40–42, 53–54). This list contains names bearing the component "Shemu" (Abi-Shemu and Yapaᶜ-Shemu-abi) (Dunand 1954, 174–175, 212–214, pl. CCI; Montet 1928, 174–177, pls. XCIX, C). The present study reveals that this Canaanite jar from stratum D/3–2 was made in the northern Levant.[18] If so, we cautiously suggest to identify *h3ty-ʿ šimw* mentioned on this jar with a prince of Byblos. Indeed, the petrographic results indicate that Canaanite vessels from the region east of the Beirouth-Byblos coastline were exported to Egypt during the SIP, and about tenth of the analyzed vessels were produced in that region (Group D).

The petrographic results show that during that Hyksos period the import from the northwestern Negev was very minor. These results are not reflecting the close relationships between Tell el-Dabᶜa and Tell el-ᶜAjjul during that period (Oren 1997, 253–83).

The present results pose some important constrains on the reconstruction of the Egypto-Canaanite relations. Based on our results, we conclude that the relations between the settlers of Tell el-Dabᶜa and the northern Levant kept flourishing during the entire MK–SIP chronological sequence. Nevertheless, these results raise many questions regarding their potency to illustrate or at least to contradict or support historical scenarios or political changes. The results may reflect on the political situation of the late 13th dynasty rulers. The increase in the amount of imports from the northwestern Negev during that time supports the presence of "rulers of foreign countries" in the Nile Delta that antedate the 15th dynasty as suggested by Bietak (1997:108–109, based on evidence from stratum F or b/3) and others (O'Connor 1997:51–52). Moreover, the changes presented by the frequencies of the vessel provenances during the late 13th dynasty (stratum F) support the low chronology of this stratum in Tell el-Dabᶜa as proposed by Bietak. We argue that changes in the trade patterns occurred during the late 13th dynasty when it was disintegrated and subsequently returned to Thebes. These changes probably did not occur during the epoch of the independent 12th and early 13th dynasties.

Appendix: Comparison with earlier NAA Results

Seventy samples from the vessels that we analyzed by petrography were previously examined by NAA (McGovern and Harbottle 1997, McGovern 2000) and a comparison to our results is mandatory. Table 3 lists the samples that were analyzed in the two studies and the provenance suggested by McGovern and us. The geology of southern

[18] This result is in opposed to previous NAA results suggesting a southern Palestinian origin for this jar (Bietak 1996:60).

Palestine, assigned by McGovern and Harbottle as the major source for the Tell el Dabca Canaanite wares (McGovern and Harbottle 1997), is well known and the lithostratigraphic units are well documented. Such is also the geology of the northern coastal plain of Israel and the Lebanese coast. The most conspicuous differences between the geology of the two areas result from the deposition of different sediments in them during the Quaternary and the difference in the exposed rocks of the bordering regions.

We tried to quantify the degree of match between our geological interpretation and the provenance given by McGovern and Harbottle. We assigned four levels of agreement between the two studies (Table 3): 1) a good agreement (marked with a "+"), where the geographic region suggested by McGovern and Harbottle agrees with our geological designation; 2) an unlikely but still possible match (marked with a "?"), where the geological units used for producing the vessel are not found in the immediate region suggested by these scholars but outcrop at a distance of several tens of kilometers; 3) an impossible NAA provenance (marked with a "—"), where the geology encountered in the thin sections of that particular vessel is incompatible with the geology in the region proposed by McGovern and Harbottle; 4) when a comparison between the two methods could not be done because at least in one of them a provenance was not determined (marked with N.D.). Of the 70 compared samples, 15 are not identified by one of the two methods and, thus, the results cannot be compared. Of the remaining 55, 18 (33%) show good matches, 3(6%) show possible match, and 33 (61%) do not match at all. The most striking difference is the systematic mismatch between the two methods when the NAA assigns a "Southern Palestine" provenance and the petrographic method assigns to these vessels a northern Levantine coastal one, based on the presence of northern Levantine coastal sediments (and occasionally volcanic rock fragments) in the thin sections (see e.g., Pl.I:m, JH132; Pl.I:f; JH915). The difference in provenance cannot be reconciled as there are no such exposures in the entire region that may be defined as "southern Palestine", even if this term is extended to cover the entire coast of Palestine south of the Carmel area. Note also that samples with entirely different petrography were assigned by NAA to very similar origins.

Since NAA sourcing relies entirely on chemical databases, the obvious culprit for the incongruent results are the intensity and refinement of the standards within the comparative database, and the statistical procedures that are used. It is neither our role nor our intention to review here the NAA study. This remarks were made by one of us elsewhere (Goren 2003) and they will not be repeated here.

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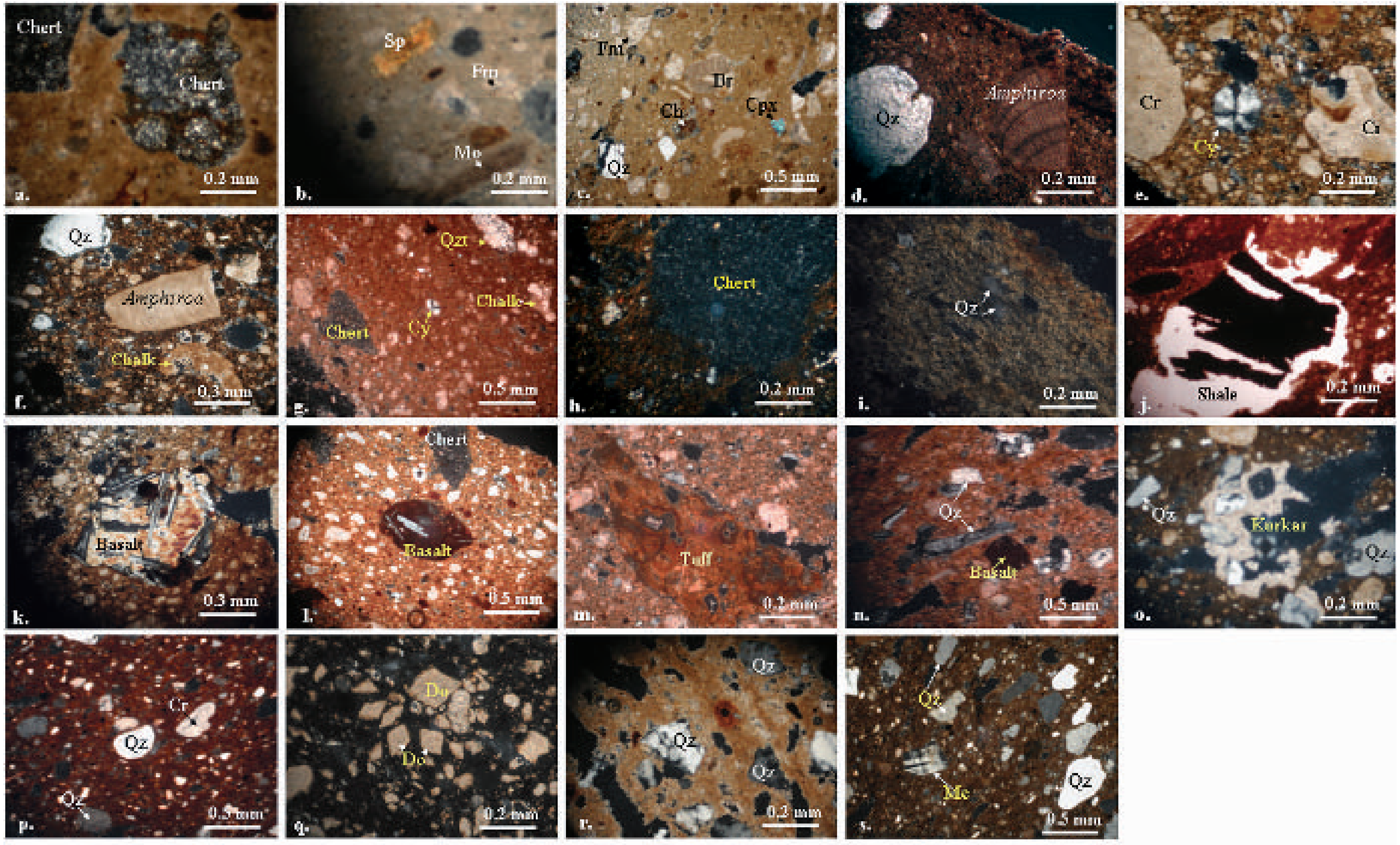
Plate I



Br=beach rock, Ch=chalcedony, Cpx=clynopyroxene, Cr=carbonatic rock fragments, Do=dolomite, Fm=foraminifer, Mc=microcline, Mo=mollusk, Qz=quartz, Qzt=quartzolith, Sp=serpentine

Plate I

Photomicrographs of:

a) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:11). Petrographic Group A1. Radiolarian chert embedded in carbonatic clay (crossed -nicoles).
b) *Canaanite handless jar* from stratum d/1, 13th dynasty (Table 1c:17). Petrographic Group A1. Serpentine and mollusk fragment embedded in carbonatic clay with foraminifera (crossed-nicoles).
c) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:18). Petrographic Group B1. Beachrock with Amphiroa sp. algae, quartz, oxidize chert, clynopyroxen and foraminifer (Morzovella?) embedded in carbonatic clay (crossed-nicoles).
d) *MB painted jug* from stratum (d/2–d/1), late 12th–13th dynasties (Table 1d:15). Petrographic Group B2. Quartz grain and Amphiroa sp. Algae embedded in carbonatic clay (crossed-nicoles).
e) *Canaanite jar* from stratum E/3–F. late 13th dynasty (Table 1d:6). Petrographic group B2. Carbonatic rock fragments and chalcedony embedded in carbonatic clay (crossed-nicoles).
f) *Painted jug* from stratum E/1–D/3. 15th dynasty (Table 1e:2). Petrographic Group B2. Amphiroa sp. Algae, chalk and quartz grain embedded in carbonatic clay with foraminifera (crossed-nicoles).
g) *Painted jug* from ᶜEzbet Rushdy stratum d–e/1, 12th dynasty (Table 1a:2). Petrographic Group B3. Chert, quartzolith, chalk and chalcedony embedded in carbonatic clay (crossed-nicoles).
h) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:27). Petrographic Group B3. Chert fragments embedded in argillaceous ferruginous clay (crossed-nicoles).
i) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:22). Petrographic Group C. Fine quartz grains embedded in argillaceous clay (crossed-nicoles).
j) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:81). Petrographic Group D. Ferruginous shale fragments in carbonatic clay (crossed-nicoles).
k) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:58). Petrographic Group E. Basalt fragment embedded in carbonatic clay rich in carbonate micrite (crossed-nicoles).
l) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c: 89). Petrographic group E. Chert and basalt embedded in carbonatic clay rich in carbonate micrite (crossed-nicoles).
m) *Canaanite jar*, 15th dynasty (Table 1e:12). Petrographic Group F. Tuff fragment embedded in carbonatic clay (crossed-nicoles).
n) *Bowl* from stratum E/1, 15th dynasty (Table 1e:43). Petrographic Group G. Quartz grains and basalt fragment embedded in carbonatic Hamric soil (crossed-nicoles).
o) *Canaanite jar* from stratum d/2, 12th–13th dynasties (Table 1b:20). Petrographic Group G. Quartz grains and kurkar fragment embedded in Hamra soil (crossed-nicoles).
p) *Canaanite jar* from stratum a/2, 15th dynasty (Table 1e:5). Petrographic Group H. Quartz grains and carbonatic rock fragments embedded in ferruginous silty Terra Rossa soil (crossed-nicoles).
q) *Canaanite jar* from stratum D/3, 15th dynasty (Table 1e:39). Petrographic Group I. Dolomite rhombs of the camminadav Formation embedded in clay of Moza Formation (crossed-nicoles).
r) *Juglet* from stratum b/1, 15th dynasty (Table 1e:4). Petrographic Group J. Quartz grains embedded in marl of the Taqiye Formation (crossed-nicoles).
s) *Canaanite jar* from stratum d/1, 13th dynasty (Table 1c:56). Petrographic Group K. Quartz and microcline grains embedded in carbonatic silty loess soil (crossed-nicoles).

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
Table 1a: Izbet Rushdi, the 12th dynasty							
1	8617A	**Group B3**	Dipper Jug (ovoid), painted with two red band zones	R/I-k/60, Loc. 313	e/2–3	Undetermind northern Levant	A
2	8617C1	**Group B3**	Jug painted with 3 or 4 thin horizontal bands	R/I-k/58/59, Pl. 7, Loc. 234	d–e/1	Undetermind northern Levant	A
3	8617X	**Group B3**	Jug painted with 2 red band zones	R/I-n/61, Pl. 3, Loc. 35 S from K7856	c	Undetermind northern Levant	A
4	K7477	**Group A2**	Canaanite amphora (body sherd)	R/I-n/60, Loc. 173	e/2	Northwestern Syria: Ugarit, Amuq area or the Cilician coast. or Cyprus	A
5	K7859	**Group K**	Canaanite jar (body sherd)	R/I-n/61, Loc. 41	e/1–2	Northwestern Negev/ Shephelah	B
6	K7948/2	**Group K**	Canaanite jar	Rushdi Loc. 25	e	Northwestern Negev	A
7	K7948/3	**Group B3**	Canaanite jar (body sherd)	R/I-m/61, Loc. 25	e	Undetermined northern Levant	A
8	K7972	**Group F**	Canaanite jar (body sherd)	R/I-m/61, Loc. 44	e/3	Mount Carmel region in Israel	A
9	K8117	**Group E**	Canaanite jar (body sherd)	R/I-m/60	d–e	Akkar plain	A
10	K8134	**Group A2**	Canaanite jar?	R/I-1/60, Loc. 26	c	Northwestern Syria: Ugarit, Amuq area or the Cilician coast *or* Cyprus	A
Table 1b: Strata d/2, H, the late 12th dynasty–13th dynasty							
1		**Group D**, NAA: JH672	Canaanite jar? (body Sherd)		No context d/1–2?	Lebanon	A
2	3336A	**Group B2**, NAA: MB025	dipper jug painted with red and black bichrome bands	F/I-j/20 Pl. 3	d/2	Northernmost Isrsaeli coast or the Lebanese coast	A
3	4223B	**Unclassified**, NAA: MB016	Jug/Jar (body fragment) painted with dark and light brown bands	F/I-i/22 Pl. 6–7	d/2	Undetermined	
4	4226	**Group B3**, NAA:MB027	Jug (painted)	F/I-i/22 Pl. 7–8	d/2	Undetermined northern Levant	B
5	4958	**Group D**, NAA: JH858	jug	F/I-m/20 tomb 23	d/2	Lebanon	B
6	5226A	**Group B3**, NAA: JH837	Beaker? Cup?	F/I-I/20 pit 53	d/2	Undetermined northern Levant	A
7	5226B	**Group B3**, NAA:JH838	Dipper Jug (ovoid), red/brown band zone on upper body and a band at collar	F/I-I/20 pit 53	d/2	Undetermined northern Levant	B
8	5226G	**Group B3**	Jug (body fragment), painted with bichrome red and black vertical lines and triangles	F/I-I/20 pit 53	d/2	Undetermined northern Levant	C
9	6114J	**Group B2**	Jug (LPW), Black and red concentric circles at the middle of body. zones of horizontal and wavy bands on lower and upper body and neck	F/I-i/22 Pl. 7–8, from K2562	d/2	Northernmost Isrsaeli coast or the Lebanese coast	A
10	6115G	**Group E**, NAA: MB015	Jar/Jug (painted)	F/I-j/23S Pl. 4–5, from K2602		Eastern Galilee or Jezreel Valley or the Yarmuq area, or the Akkar or Middle Orontes north of Qedesh	B
11	6137X	**Group B2**	Juglet (fragments with beginning of neck) Painted with red and white band zones	F/I-l/20 Pl. 2 (fits to sherd from pit)	d/2	Northernmost Israeli coast or the Lebanese coast	A
12	6978G	**Group B3**	Canaanite jar	F/I-o/21 Pl. 1–2	e/1–2 or d/2	Undetermined northern Levant	C
13	7027A	**Group B1**	jug	F/I-o/20 tomb 20	d/2	Northern Lebanese coast (north of Tripoli)	A
14	7044K	**Group A1**	Jug/jar (shoulder fragment) Painted with brown horizontal and wavy bands	F/I-p/19 tomb 1	d/2	Northwestern Syria: Ugarit Amuq area or the Cilician coast	A
15	7067G (261)	**Group B2**	Jug/Jar (body fragment) Painted with horizontal bands		d/2–1	Northernmost Israeli coast or the Lebanese coast	A
16	7151B	**Group B1**	Jug/jar (shoulder fragment) Painted with black horizontal band and thin red lines.	F/I-n/18 tomb 5, from K3710	d/2	Northern Lebanese coast (north of Tripoli)	A
17	K0478	**Group B3**, NAA: PMG107	Canaanite jar	A/II-m/14 Pl. 6–7	G–H	Undetermined northern Levant	A
18	K0508.1	**Group B3**	Canaanite jar	A/II-m/14 Pl. 7–8	G–H	Undetermined northern Levant	B
19	K1665 (201)	**Group B2**	Globular bowl	F/I-j/20 Pl. 3–4	d/2	Northernmost Israeli coast or the Lebanese coast	A
20	K2567	**Group G**, NAA: PMG111	Canaanite jar	F/I-p/22	d/2	Central coast of Israel	A
21	K3321 IV-2–3	**Group F**	Cooking Pot	F/I-l/20, pit 53	d/2	Mount Carmel region in Israel	A

* The NAA sample's numbers are those used by McGovern (McGovern 2000) and accompanied by the prefix JH=Joan Huntoon or PMG=Patrick, E. McGovern or MB

** The results were classified according to their relibility. A – the origin is highly reliable; B - the origin is less reliable than A; C – the origin is poorly reliable

Table 1 Inventory and results of the petrographically examined vessels (sorted first by strata and period and then by basket numbers)

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
Table 1c: Strata G, d/1–c, the 13th dynasty							
1	2532C (1)	**Group D**, NAA: JH055	Canaanite jar	A/II-n/15 Pl. 4	G	Lebanon	A
2	2660B	**Group B2**, N.A.A:JH136	Canaanite jar	A/II-n/14–15 Pl. 4	G	Northernmost Israeli coast or the Lebanese coast	A
3	3394A (63)	**Group K**	Juglet (black burnished)	F/I-J/21, Tomb 10	c–b/3	Southern Shephela	A
4	4030B	**Group K**, NAA: JH066	Canaanite jar	A/II-p/21 Pl. 6	G	Northwestern Negev/ southern Shephelah	A
5	4060D	**Group F**, NAA: JH010	Canaanite jar	F/I-i/23 Pl. 2–3	c	Mount Carmel region in Israel	A
6	4503	**Group K**, NAA: JH115	Jug (red/brown polished large jug)	F/I-k/20 Palace. Under tomb 28A	d/1	Northwestern Negev	B
7	4536 (=3983A)	**Group K**, NAA: JH089	Canaanite jar	F/I-j/22 tomb 29	c	Northwestern Negev/ southern Shephelah in Palestine	A
8	4539	**Group K**, NAA: JH152	Juglet (Tell el-Yahudiya piriform 1b	F/I-k/22 tomb 7	c	Northwestern Negev	A
9	4851 (59)	**Group D**, NAA:JH833	juglet (stepped rim)	Tomb 35	Late c	Lebanon	B
10	4951A	**Group F**, NAA: JH726	Tankard/goblet	F/I-m/20 tomb 1	d/1	Mount Carmel region in Israel	C
11	5642A	**Group A1**	Canaanite jar	F/I-k/19 Pl. 0–1	d/1?	Northwestern Syria: Ugarit, Amuq area or the Cilician coast	A
12	5709	**Group B3**, NAA: PMG124	Canaanite jar	F/I-m/18 tomb 3	d/1	Undetermined northern Levant	A
13	5816	**Group F**, NAA:PMG 131	Canaanite jar	F/I-m/19	c	Mount Carmel region in Israel	A
14	5824	**Group B2**, NAA: PMG123	Canaanite jar	F/I-m/18 tomb 3	d/1	Northernmost Israeli coast or the Lebanese coast	A
15	5826	**Group B1**, NAA: PMG117	Canaanite jar	F/I-m/18 tomb 3	d/1	The Lebanese coast (north of Tripoli)	A
16	5828	**Group B2**, NAA: PMG119	Canaanite jar	F/I-m/18 tomb 3	d/1	Northernmost Israseli coast or the Lebanese coast	A
17	5894	**Group A1**, NAA: PMG120	Canaanite handless jar	F/I-m/18 tomb 3	d/1	Northwestern Syria: Ugarit, Amuq area or the Cilician coast	A
18	5894C	**Group B1**, NAA: PMG121	Canaanite jar	F/I-k/20	d/1	Northern Lebanese coast (north of Tripoli)	A
19	5915J	**Group B3**	jug	F/I-m/19 tomb 22	d/1	Undetermined northern Levant	B
20	6114E	**Group B3**, NAA: MB029	Jug/jar. Painted with red hanging triangle–band on shoulder and standing triangle band on mid-body	F/I-l/20 pit 40, from K2817	d/1	Undetermined northern Levant	C
21	6115Y	**Unclassified**, NAA: MB018	Jar (painted rim)	F/I-l/19-20 pit 40, from K2817	d/1	Undetermined	
22	6175	**Group C**	Canaanite jar	F/I-I/19 tomb 1	d/1	Byblos, Lebanese coast	B
23	6176E	**Group B3**	Canaanite jar	F/I-l/19 tomb 1	d/1	Levantine undetermined	B
24	6176F	**Group B2**	Canaanite jar	F/I-l/19 tomb 1	d/1	Northernmost Israseli coast or the Lebanese coast	A
25	6176G	**Group C**	Canaanite jar	F/I-l/19 tomb 1	d/1	Byblos, Lebanese coast	B
26	6176H	**Group K**	Canaanite jar	F/I-l/19 tomb 1	d/1	southern Shephelah in Israel	A
27	6176I	**Group B3**	Canaanite jar	F/I-l/19 tomb 1	d/1	Undetermined northern Levant	B
28	6176K (296)	**Group B3**	Canaanite jar	Tomb 34	d/1	Undetermined northern Levant	C
29	6176L	**Group D**	Canaanite jar	F/I-l/19 tomb 1	d/1	Lebanon	A
30	7020	**Group G**	Canaanite jar	F/I-I/19 tomb 1	d/1	Central coast of Israeli	A
31	7020Y	**Group B3**	Canaanite jar	F/I-l/19 tomb 1	d/1	Undetermined northern Levant	C
32	7029A	**Group D**, NAA: PMG105	Jug	F/I-o/20 Pl. 0–1	d/1	Lebanon	A
33	7062K	**Unclassified**	Jug. Painted with red horizontal and wavy bands on shoulder	F/I-P/21 tomb 1	d/1	undetermined	
34	7259	**Group B3**	Dipper juglet	F/I-o/17 tomb 5	d/1	Undetermined northern Levant	A
35	7260	**Group B3**	Jug	F/I-o/17 tomb 5	d/1	Undetermined northern Levant	A
36	7280A	**Group B2**	Canaanite jar	F/I-o/17 tomb 1	d/1	Northernmost Israeli coast or Lebanese coast	A
37	7285	**Group K**	Canaanite jar	F/I-m/17 tomb 1	d/1	Northwestern Negev	A
38	7299A	**Group B2**	Canaanite jar	F/I-o/17 tomb 6	d/1	Northernmost Israeli coast or Lebanese coast	A
39	7340	**Group B2**	Dipper jug	F/I-p/17 tomb 14	d/1	Northernmost Israeli coast or Lebanese coast	A
40	7343A	**Group B2**	Canaanite jar	F/I-p/17 tomb 14	d/1	Northernmost Israeli coast or Lebanese coast	A
41	7345	**Group B3**	Canaanite jar	F/I-p/17 tomb 14	d/1	Undetermined northern Levant	A
42	7350F	**Group K**	Juglet	F/I-l/16 detail 1. tomb	d/1	Southern Shephelah in Israel	A

Table 1 continued

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
43	7362	**unclassified**	Canaanite jar	F/I-m/17 tomb 1	d/1	Undetermined	
44	K0983.1	**Group B2**	Canaanite jar	A/II-p/16 Pl. 2–3	G–F	Northernmost Israeli coast or the Lebanese coast	A
45	K0999.4	**Group G**	Canaanite jar		G?	Central coast of Israel	A
46	K1101.2	**Group B2**	Canaanite jar	A/II-r/18 Pl. 3–4 pit	G?	Northernmost Israeli coast or Lebanese coast	A
47	K1113.1	**Group G**	Canaanite jar	A/II-o/16 Pl. 4–5	G	Central coast of Israel	A
48	K1172.1	**Group B3**	Canaanite jar	A/II-r/18 Pl. 4–5	G?	Northern Levant	B
49	K1172.3	**Group G**	Canaanite jar		G?	Central coast of Israel	A
50	K1185.3	**Group K**	Canaanite jar	A/II-o/16 Pl. 4–5	G	Northwestern Negev/ Southern Shephelah	A
51	K2574	**Group B2**, NAA: PMG115	Jar (body sherd).	F/I-i/23 Pl. 5–6	d/1	Northernmost Israeli coast or Lebanese coast	A
52	K2574	**Group B2**, NAA: PMG114	platter	F/I-i/23 Pl. 5–6	d/1	Northernmost Israeli coast or Lebanese coast	A
53	K2771	**Group D**, NAA: PMG 106	Canaanite jar	F/I-k/20 Pl. 3	c	Lebanon	A
54	K2815 (291)	**Group D**	oil lamp	F/I-k/22 Pl. 3	c	Lebanon	A
55	From K2817 (67)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	A
56	From K2817 (69)	**Group K**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northwestern Negev	A
57	From K2817 (70)	**Group B3**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northern Levant	B
58	From K2817 (72)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar Plain	A
59	From K2817 (73)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar Plain	A
60	From K2817 (74)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar Plain	A
61	From K2817 (75)	**Group B2**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
62	From K2817 (76)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	B
63	From K2817 (77)	**Group F**	Canaanite jar	F/I-I/20 Pit 40	d/1	Mount Carmel region in Israel	A
64	From K2817 (78)	**Group F**	Canaanite jar	F/I-I/20 Pit 40	d/1	Mount Carmel region in Israel	A
65	From K2817 (79)	**Group B1**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northern Lebanese coast (north of Tripoli)	A
66	From K2817 (80)	**Group F**	Canaanite jar	F/I-I/20 Pit 40	d/1	Mount Carmel region in Israel	B
67	From K2817 (81)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	B
68	From K2817 (82)	**Group G**	Canaanite jar	F/I-I/20 Pit 40	d/1	Central coast of Israel	A
69	From K2817 (83)	**Group B2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
70	From K2817 (84)	**Group B3**,	Canaanite jar	F/I-I/20 Pit 40	d/1	Undetermined northern Levant	C
71	K2817 (85)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar plain	B
72	K2817 (86)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	A
73	K2817 (90)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	A
74	K2817 (91)	**Group B2**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
75	K2817 (93)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	A
76	K2817 (96)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	B
77	K2817 (97)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	A
78	From K2817 (98)	**Group G/B2**	Canaanite jar	F/I-I/20 Pit 40	d/1	Central or northern Levantine coast.	B
79	From K2817 (99)	**Group B3**	Canaanite jar	F/I-I/20 Pit 40	d/1	Undetermined northern Levant	C
80	From K2817 (100)	**Group B2**	Canaanite jar	F/I-I/20 Pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
81	From K2817 (101)	**Group D**	Canaanite jar	F/I-I/20 Pit 40	d/1	Lebanon	A (basalt)
82	From K2817 (102)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Eastern Galilee or Jezreel Valley or the Yarmuq area, or the Akkar or Middle Orontes north of Qedesh	B
83	K2817 (103)	**Group G**	Canaanite jar	F/I-I/20 Pit 40	d/1	Central coast of Israel	B

Table 1 continued

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
84	K2817 (104)	**Group B2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
85	K2817 (105)	**Group G**	Canaanite jar	F/I-I/20 pit 40	d/1	Central coast of Israel	A
86	K2817 (106)	**Group G**	Canaanite jar)	F/I-I/20 pit 40	d/1	Central coast of Israel/ Menashe hills/Shephelah	B
87	From K2817 (107)	**Unclassified**	Canaanite jar	F/I-I/20 Pit 40	d/1	Undetermined northern Levant	
88	From K2817 (108)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar Plain	A
89	From K2817 (109)	**Group E**	Canaanite jar	F/I-I/20 Pit 40	d/1	Akkar Plain	A
90	K2817 (110)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	A
91	K2817 (111)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	C
92	K2817 (113)	**Group B1**	Canaanite jar	F/I-I/20 pit 40	d/1	Northern Lebanese coast (north of Tripoli)	A
93	K2817 (114)	**Group B2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
94	K2817 (115)	**Group B2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
95	K2817 (116)	**Group B2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northernmost Israeli coast or the Lebanese coast	A
96	K2817 (117)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	C
97	K2817 (118)	**Group A2**	Canaanite jar	F/I-I/20 pit 40	d/1	Northwestern Syria: Ugarit, Amuq area or the Cilician coast *or* Cyprus	B
98	K2817 (119)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	C
99	K2817 (120)	**Unclassified**	Canaanite jar	F/I-I/20 pit 40	d/1	Unidentified	
100	K2817 (121)	**Group D**	Canaanite jar	F/I-I/20 pit 40	d/1	Lebanon	A
101	K2817 (128)	**unclassified**	Canaanite jar	F/I-I/20 pit 40	d/1	Undetrmined	
102	K2817 (131)	**Unclassified**	Canaanite jar	F/I-I/20 pit 40	d/1	Undetermined	
103	K2817 (132)	**Group D**	Bowl	F/I-I/20 pit 40	d/1	Lebanon	A
104	K2849 (230)	**unclassified**	Canaanite jar		c		
105	K2849 (231)	**Group B3**	Canaanite jar		c	Undetermined northern Levant	C
106	K3456	**Group K**, NAA: PMG125	Canaanite jar	F/I-l/23 silo 22	disturbed	Northwestern Negev	A
107	K3592	**Group D**	Juglet	F/I-k/22 Pl. 3	c	Lebanon	A
108	K3634	**Unclassified**,	Jug	F/I-l/23 Pl. 4–5	d/1	undetermined	
109	K3656	**Group G**, NAA: PMG104	Canaanite jar	F/I-l/23 Pl. 4–5	d/1	Central Israeli coast.	A
Table 1d: Strata F–E/3, b/3–b/2, the late 13th dynasty (14th dynasty)							
1	2497E	**Group B2**, NAA: JH073	Canaanite jar	A/II-m/10 Pl. 4–5	F	Northernmost Israeli coast or the Lebanese coast	A
2	2532A	Group F	Bowl	A/II-n/15 Pl. 5–6	E/3–F	Mount Carmel region in Israel	B
3	3260C	**Group A2**	Jug (Cypriote?)	A/II-o/15–16 out of temple wall	F–E/3	Northwestern Syria: Ugarit, Amuq area or the Cilician coast *or* Cyprus	B
4	3955A	**Group D**, NAA: JH075	Canaanite jar	F/I-i/22 tomb 33	b/3	Lebanon	A
5	3959B	**Group B2**, NAA: JH077	Canaanite jar	F/I-i/23 tomb 26	b/2	Northernmost Israeli or southern Lebanese coast	A
6	3959C	**Group B2**	Canaanite jar	A/II-l/17 Pl. 6	E/3–F	Northernmost Israeli coast or the Lebanese coast	A
7	4099C	**Group I**, NAA: JH084	Canaanite jar	F/I-j/21 tomb 4	b/2	Judea or Samaria hills	A
8	4547 (51)	**Group K**	Carinated bowl red/brown slipped and burnished	Tomb 36	b/3	Northwestern Negev	A
9	**4551B**	**Group B2**, NAA: JH045	Canaanite jar	F/I-k/24 Pl. 2	b/3	Northernmost Israeli coast or the Lebanese coast	A
10	4551C	**Group B2**, NAA: JH046	Canaanite jar	F/I-k/20 pit 19	b/2	Northernmost Israeli coast or the Lebanese coast	A
11	4551E	**Group K**, NAA: JH048	Canaanite jar	F/I-k/20 pit 30	b/2	Northwestern Negev	A
12	4551L	**Group B2**, NAA: JH043	Canaanite jar	F/I-k/23 Pl. 3	b/3	Northernmost Israeli coast or the Lebanese coast	A
13	4553A	**Group B2**, NAA: JH095	Canaanite jar	F/I-I/21 tomb 18	b/3	Northernmost Israeli coast or the Lebanese coast	A
14	4630A	**Group B3**, NAA: JH109	Canaanite jar	F/I-k/24 tomb 48	b/3	Undetermined northern Levant	B
15	4630D	**Group E**, NAA: JH113	Canaanite jar	F/I-I20 tomb 20	b/3–2	Akkar plain	A
16	4632D	**Group B3**, N.A.A: JH118	Canaanite jar	F/I-i/23 tomb 25	b/3–2	Undetermined northern Levant	A
17	4779	**Group B3**, NAA: JH611	Canaanite jar	F/I-k/21 tomb 31	b/3	Undetermined northern Levant	A

Table 1 continued

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
18	4972	**Group D**, NAA: JH717	Juglet (red polished, missing base)	F/I-k/21 tomb 24	b/3	Lebanon	A
19	4978	**Group D**, NAA: JH688	juglet (Tell el-Yahudiya, piriform 1b/c)	F/I-k/21 tomb 30	b/3	Lebanon	A
20	5894D	**Group B2**	Canaanite jar	F/II-l/22 tomb 20	b/3–2	Northernmost Israeli coast or the Lebanese coast	A
21	6067A (149)	**Group K**	Juglet (red polished).	Tomb 5	b/3	Southern Shephelah	A
22	6114Q	**Group B3**	Jjuglet ("Painted Tell el Yahudiya", body sherd)	F/I-j/23N Pl. 0–1, from K2573	b/2	Undetermined northern Levant	B
23	6116 (138)	**Unclassified**	Juglet	Tomb 5	b/3–2	undetermined	
24	6979	**Group K**	Canaanite jar	F/I-Il/23 tomb 25	b/2–3	Northwestern Negev	A
25	6991	**Group** H	Canaanite jar	F/I-I/23 tomb 34	b/2–3	Judea, Samaria, or Galilee mountains	A
26	7486D (144)	**Group A2**	Juglet (red polished)	A/IV-h/4 tomb 11	F–E/3	Northwestern Syria: Ugarit, Amuq area or the Cilician coast Or Cyprus	B
27	7486G (146)	**Group F**	Juglet (black burnished)	Tomb 11/13	F–E/3	Mount Carmel region in Israel	C
28	8564E	**Group E**	Cooking Pot (upright rim, rounded bottom)	A/IV-g/5 Pl. 2–3 from K4236+K4256	F	Eastern Galilee or the Yarmuq area, *or* the Akkar *or* Middle Orontes north of Qedesh	B
29	K2146 (274)	**Group B3**	Bowl (incurved rim)	A/II-m/18 Pl. 4	E/2	Undetermined northern Levant	C
30	K2300 (249)	**Group B3**	Canaanite jar	A/II-n/17 Pl. 2–3	E/3	Undetermined northern Levant	B
31	K2310.5	**Group G**	Canaanite jar	A/II-n/17 Pl. 3–4	E/3?	Central coast of Israeli	A
32	K2409 (1)	**unclassified**	Canaanite jar	F/I-j23N Pl. 1–2	b/3–2	undetermined	
33	K2409 (2)	**Group B2**	Canaanite jar	F/I-j23N Pl. 1–2	b/3–2	Northernmost Israeli coast or the Lebanese coast	A
34	K2409 (3)	**Group G**	Canaanite jar	F/I-j/23N Pl. 1–2	b/3–2	Central coast of Israel	A
35	K2409 (4)	**Group K**	Canaanite jar	F/I-j/23N Pl. 1–2	b/3–2	Northwestern Negev/Shephelah	A
36	K2409 (5)	**Group K**	Canaanite jar	F/I-j/23N Pl. 1–2	b/3–2	Northwestern Negev	A
37	K2409 (6)	**Group K**	Canaanite jar	F/I-j/23N Pl. 1–2	b/3–2	Shephelah region in Israel	A
38	K2409 (8)	**Group K**	Canaanite jar	F/I-j/23N Pl. 1–2	b/3–2	Northwestern Negev	A
39	K2810	**Group B1/B2**, NAA: JH108	Canaanite jar	F/I-k/24 tomb 48, filling	disturbed	Northern Lebanese coast (north of Tripoli)?	A
40	K5568 (174)	**unclassified**	Canaanite jar	A/IV-Dep. Pl. 5–6 under L115	E/3	undetermined	
41	K5568 (175)	**Group B2**	Canaanite jar	A/IV-Dep. Pl. 5–6 under L115	E/3	Northernmost Israeli coast or the Lebanese coast	A
42	K5568 (176)	**Group K**	Canaanite jar	A/IV-Dep. Pl. 5–6 under L115	E/3	Shephelah in Israel	A
43	K5568 (177)	**Group D**	Canaanite jar	A/IV-Dep. Pl. 5–6 under L115	E/3	Lebanon	C
44	K5568 (178)	**Group A1**	Canaanite jar	A/IV-Dep. Pl. 5–6 under L115	E/3	Northwestern Syria: Ugarit Amuq area or the Cilician coast	A
45	K5570 (164)	**Group B3**	Canaanite jar		E/3	Undetermined northern Levant	A
46	K5570 (165)	**Group K**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Northwestern Negev	A
47	K5570 (166)	**Grooup D**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Lebanon	A
48	K5570 (167)	**Group G**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Central coast of Israel	A
49	K5570 (168)	**Group B2**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Northernmost Israeli coast or the Lebanese coast	A
50	K5570 (170)	**Group B2**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Northernmost Israeli coast or the Lebanese coast	A
51	K5570 (171)	**Group E**	Canaanite jar	A/IV-Dep. Pl. 5–6	E/3	Akkar plain	A
52	K5570 (172)	**Unclassified**	Canaanite jar		E/3	Undetermined	
53	K5572 (180)	**Group D**	Canaanite jar	A/IV-Dep. Pl. 5–6, L128	E/3	Lebanon	B
Table 1e: Strata E/2–D/2, b/1 the 15th Hyksos dynasty							
1	2497G	**Group E**, NAA:JH072	Canaanite jar	A/II-m/12 tomb 4	D/3	Akkar plain/Jezreel Valley	B
2	2879G	**Group B2**, NAA: JH915	Jug/jar (body fragment) Red burnished with painted vertical black band	A/II-r/18 filling of tomb/ pit- in residence	E/1–D/3	Northern most Israeli coast or the Lebanese coast	A
3	3423C	**Group A2**, NAA: JH916	Jug, Cypriote?	A/II-p/20 tomb 3, robbers pit	E/2–(1)	Northwestern Syria: Ugarit, Amuq area or the Cilician coast *or* Cyprus	A
4	4107A	**Group J**, NAA: JH903	Juglet	F/I-j/22 Pl. 1 depot 1	b/1	Shephela/Wadi Iʿron	A
5	4426C	**Group** H	Canaanite jar	F/I-k/23 Pl. 4	a/2	Judean/Samarian or Galilee mountains	B
6	4505A	**Group G**, NAA: JH061	Canaanite jar	F/I-k/23 tomb 3	b/1	Central coast of Israel	A

Table 1 continued

No’	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
7	4537=4032 c	**Group B3**, NAA: JH091	Canaanite jar with seal impression *h3ty-ʿ ši͗mw*	A/II-l/17 tomb 8	D/3–2	Undetermined northern Levant	A
8	4537A	**Group B3**, NAA: JH013	Canaanite jar	A/II-l/17 tomb 17	E/2	Undetermined northern Levant	A
9	4549C	**Group B2**, NAA: JH029	Canaanite jar	F/I-i/22 pit 10	b/2–1	Northernmost Israeli coast or the Lebanese coast	A
10	4551F	**Group G**, NAA: JH049	Canaanite jar	A/II-I/16 tomb 6 L021	D/3	Central coast of Israel	B
11	4552E	**Group B2**, NAA: JH079	Canaanite jar	A/II-k/12 Pl. 1–2	E/1	Northernmost Israeli coast or the Lebanese coast	A
12	4636A	**Group F**, NAA: JH132	Canaanite jar	provenance unknown	no context	Mount Carmel region in Israel	A
13	5203	**Group B2**, NAA: JH703	Canaanite jar	F/I-k/23S tomb 4	b/1	Northernmost Israeli coast or the Lebanese coast	A
14	5251 (318)	**Group A1**	Canaanite storage jar (handleless)	A/II-k/9 tomb 39	D/2	Northwestern Syria: Ugarit, Amuq area or the Cilician coast	B
15	5822Q	**Group B1**, NAA: JH696	Canaanite jar	F/I-l/22 tomb 4	b/1	Lebanese coast (north of Tripoli)	A
16	6016 (54)	**Group B3**	Jar (red burnished)	F/I-o/20 tomb 12	E/3–E/1	Undetermined northern Levant	B
17	6415D or 6451D from K3360) (66)	**Group J**	Cooking pot	A/II-k/17 Pl. 3	E/1	Shephelah	B
18	6469A	**Group B3**	Canaanite jar	A/V-m/18 Pl. 2 L037	D/2	Undetermined northern Levant	A
19	6500W (3)	**Group B3**	Canaanite jar	A/V-o/17 Pl. 1 L144	D/2	Undetermined northern Levant	A
20	6789D	**Group B3**	Canaanite jar	A/V-o/18 Pl. 2 L163	D/2	Undetermined northern Levant	A
21	6814E	**Group F**	Canaanite jar	A/V-p/19 Pl. 3–4	D/3	Mount Carmel region in Israel	A
22	6983	**Group B2**	Canaanite jar	F/I-I/23 tomb 2	a/2	Northernmost Israeli coast or the Lebanese coast	A
23	7254C	**Group D**, NAA: PMG103	Juglet	A/II-o/20 Pl. 4–5	E/3–1	Lebanon	A
24	7443E (143)	**Group B1**	Juglet (black polished)	Tomb 17	E/3–E/2	Akkar area	A
25	7590 (50)	**Group D**	Dipper juglet	Tomb 5	E/1	Lebanon	B
26	7596	**Group B1**	Juglet	Surface		Northern Lebanese coast (north of Tripoli)	A
27	7901 (56)	**Group D**	Bowl	Tomb 6	Late b/2	Lebanon	A
28	K411	**Group A1**, NAA: JH002	Juglet	A/II-l/14–15 filling of tomb pit	D/3–2	Northwestern Syria: Ugarit, Amuq area or the Cilician coast	A
29	K2146 (263)	**Group D**	Canaanite jar	A/II-m-18 Pl. 4	E/2	Lebanon	A
30	K2146 (264)	**Group B3**	Canaanite jar	A/II-m-18 Pl. 4	E/2	Northernmost Israeli coast or the Lebanese coast	B
31	K2146 (265)	**Group B1**	Canaanite jar	A/II-m-18 Pl. 4	E/1	Lebanese coast north of Tripoli	B
32	K2146 (266)	**Group K**	Canaanite jar	A/II-m-18 Pl. 4	E/2	Northwestern Negev	A
33	K2146 (267)	**Group B3**	Canaanite jar	A/II-m-18 Pl. 4	E/2	Undetermined northern Levant	B
34	K2146 (268)	**Group E**	Canaanite jar	A/II-m-18 Pl. 4	E/2	Akkar plain	A
35	K3342 (234)	**Group D**	Canaanite jar	A/II-k/16 Pl. 2–3	E/1–D/3	Lebanon	B
36	K3342 (235)	**Group D**	Canaanite jar	A/II-k/16 Pl. 2–3	E/1–D/3	Lebanon	B
37	K3342 (236)	**Group A2**	Canaanite jar	A/II-k/16 Pl. 2–3	E/1–D3	Northwestern Syria: Ugarit, Amuq area or the Cilician coast *or* Cyprus	A
38	K3342 (237)	**Group E**	Jar/pot	A/II-k/16 Pl. 2–3	E/1–D/3	Akkar plain	B
39	K3429 (184)	**Group I**	Canaanite jar	A/V-p/19 Pl. 4–5	D/3	Judean/Samaria Hill	A
40	K3449 (189)	**Group G**	Canaanite jar	A/V-p/19 Pl. 4	D/3	Central coast of Israel	B
41	K3449 (190)	**Group B3**	Canaanite jar	A/V-p/19 Pl. 4	D/3	Undetermined northern Levant	A
42	K3449 (191)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 4	D/3	Northernmost Israeli coast or the Lebanese coast	A
43	K3450 (156)	**Group G**	Bowl	A/V-p/19 Pl. 7	E/1	Carmel coast	A
44	K3450 (157)	**Group K**	Canaanite jar	A/V-p/19 Pl. 7	E/1	Northwestern Negev	A
45	K3478 (140)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 4–5	D/3	Northernmost Israeli coast or the Lebanese coast	A
46	K3479 (141)	**Group B2**	Canaanite jar		D/3	Northernmost coast of Israel or the Lebanese coast	A
47	K3488 (161)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 6	E/1	Northernmost coast of Israel or the Lebanese coast	A
48	K3488 (183)	**Group B3**	Canaanite jar	A/V-p/19 Pl. 6	E/1	Undetermined northern Levant	A
49	K3490 (241)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 1–2	D/2	Northern Israeli coast or the Lebanese coast	A
50	K3490 (242)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 1–2	D/2	Northernmost Israeli coast or the Lebanese coast	B
51	K3490 (243)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 1–2	D/2	Northernmost coast of Israel or the Lebanese coast.	A

Table 1 continued

No'	Basket	Petrographic Group / NAA Number*	Type	Area/Loc.us	Stratum	Provenance	Relia-bility**
52	K3491 (187)	**unclassified**	Canaanite jar	A/V-p/19 Pl. 4–5	D/3	Undetermined	
53	K3491 (188)	**Group A1**	Canaanite jar	A/V-p/19 Pl. 4–5	D/3	Northwestern Syria: Ugarit, Amuq area or the Cilician coast	A
54	K3496 (198)	**Group B3**	Canaanite jar		D/3	Undetermined northern Levant	B
55	K3499 (185)	**Group B1/B2**	Canaanite jar	A/V-p/19 Pl. 4–5	D/2	Northernmost Israeli coast or the Lebanese coast	A
56	K3499 (186)	**Group A2**	Canaanite jar	A/V-p/19 Pl. 4–5	D/3	Northwestern Syria: Ugarit, Amuq area or the Cilician coast or Cyprus	A
57	K3510 (159)	**Group K**	Canaanite jar	A/V-p/19 Pl. 7	E/1	Northwestern Negev	A
58	K3518 (182)	**Group B3**	Canaanite jar	A/V-p/19 Pl. 6	E/1	Undetermined northern Levant	A
59	K3519 (194)	**Group B2**	Canaanite jar	A/V-p/19 Pl. 5–6	D/3	Northernmost Israeli coast or the Lebanese coast	A

Table 1 continued

Petrographic Groups / Dynasties	12th–13th Dynasties	13th Dynasty	Late 13th Dynasty	15th Dynasty	Total
A1	1	2	1	3	7
A2	0	1	2	3	6
B1	2	4	1	5	12
B2	5	21	12	13	51
B3	7	15	7	12	41
C	0	2	0	0	2
D	2	22	6	6	36
E	1	7	3	3	14
F	1	6	2	2	11
G	1	9	3	4	17
H	0	0	1	1	2
I	0	0	1	1	2
J	0	0	0	2	2
K	0	11	10	3	24
Unclassified	1	9	4	1	15
total	21	109	53	59	242

Table 2 Number of petrographically analyzed vessels from each petrographic group along the tested chronological sequence (The Nile made vessels are not included)

	Sample	NAA provenance, most similar sample	Petrographic gr.	Geologic source	Match
1	2497E NAA: JH073	Import from southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
2	2497G NAA:JH072	Most similar to Tell el-Dabʿa JH818, import from southern Palestine	Group E	Akkar plain/Jezreel Valley	–
3	2532C NAA: JH055	no matches	Group D	Lebanon east of the coast line Beirut-Byblos	N.D.
4	2660B NAA: JH136	Import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
5	2879G NAA: JH915	most similar To tell el Dabʿa JH130, import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
6	3336A NAA MB025	Import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
7	3423C NAA: JH916	no matches	Group A2	Northwestern Syria: Ugarit, Amuq area or the Cilician coast or Cyprus	N.D.
8	3955A NAA: JH075	most similar to Southern Palestine	Group D	Lebanon east of the coast line Beirut-Byblos	–
9	3959B NAA: JH077	most similar to Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
10	4030B NAA:JH066	Import from Southern Palestine	Group K	Northwestern Negev	+
11	4060D NAA: JH010	Import from Southern Palestine	Group F	Mt. Carmel region	–
12	4099C NAA: JH084	most similar to southern Palestine	Group I	Judea or Samaria in Israel	?
13	4107A NAA: JH903	most similar to southern Palestine and tell el Dabʿa JH892.	Group J	Shephelah/ Wadi Iʿron	?
14	4223B NAA:MB016	Most similar to Southern Palestine	Unclassified	Unknown	N.D.
15	4226 NAA: MB027	Most similar to Tell el-Dabʿa JH083, Southern Palestine	Group B3	Undetermined northern Levant	–
16	4426C NAA:JH064	Import from Southern Palestine	Group H	Judea/Samaria/Galilee mountains	?
17	4503 NAA: JH115	Import from Southern Palestine	Group K	Negev coastal plain in Israel	+
18	4505A NAA: JH061	most similar to Southern Palestine and Tell el-Dabʿa JH119	Group G	Central coast of Israel	?
19	4536 NAA: JH089	most similar to Southern Palestine	Group K	Northwestern Negev / Southern Shephelah	+
20	4537 NAA:JH091	Import from Southern Palestine	Group D/B3	Lebanon east of the coast line Beirut-Byblos	–
21	4537A NAA: JH013	Most similar to Southern Palestine	Group B3	Undetermined northern Levant	–
22	4539 NAA: JH152	Egyptian Nile alluvium	Group K	Northwestern Negev	–
23	4548C NAA: JH040	Nile alluvium	Nile Sediment	Nile Valley	+
24	4549C NAA:JH029	Nile alluvium	Group B2	Northernmost Israeli coast or the Lebanese coast	–
25	4550B NAA: JH033 - 036	Import from Southern Palestine	Nile Sediment	Nile Valley	–
26	4551B NAA: JH045	Import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
27	4551C NAA: JH046	similar to tell el Dabʿa MB028, uncertain provenance	Group B2	Northernmost Israeli coast or the Lebanese coast	N.D.
28	4551E NAA:JH048	Import from Southern Palestine	Group K	Northwestern Negev	+
29	4551F NAA: JH049	most similar to Southern Palestine	Group G	Central coast of Israel	?
30	4551L NAA: JH043	Import from Southern Palestine	Group B2	Northernmost Israel or the Lebanese coast	–
31	4552E NAA: JH079	similar to Tel Ifshar J557 or Tell el-Dabʿa JH802 from southern Palestine	Group B2	Northernmost Israel coast or the Lebanese coast	–
32	4553A NAA: JH095	Import from Southern Palestine	Group B2	Northernmost Israel coast or the Lebanese coast	–
33	4630A NAA: JH109	most similar to Southern Palestine	Group B3	Undetermined northern Levant	–
34	4630D NAA: JH113	most similar to Ebla	Group E	Eastern Galilee or the Yarmuq area, or the Akkar or Middle Orontes north of Qedesh	+
35	4636A NAA:JH132	Most similar to Qatna JH482, import from Southern Palestine	Group F	Mount Carmel area in Israel	–
36	4777 NAA: JH657	Import from Southern Palestine	Nile Sediment	Nile Valley	–

Table 3 Comparison between NAA and petrographic results (sorted according to basket numbers)

	Sample	NAA provenance, most similar sample	Petrographic gr.	Geologic source	Match
37	4779 NAA: JH611	Import from Southern Palestine	Group B3	Undetermined northern Levant	–
38	4951A NAA:JH726	No matches	Group F	Mount Carmel region	N.D.
39	4958 NAA: JH858	Import from Southern Palestine	Group D	Lebanon east of the coast line Beirut-Byblos	–
40	4972 NAA: JH717	most similar to Tell el-Dabʿa JH073, import from Southern Palestine	Group D	Lebanon east of the coast line Beirut-Byblos	–
41	4978 NAA: JH688	most similar to Southern Palestine and Qatna JH485, uncertain provinience	Group D	Lebanon east of the coast line Beirut-Byblos	N.D.
42	4980 NAA: JH856	Egyptian Nile alluvium	Nile Sediment	Nile Valley	+
43	5203 NAA: JH703	Import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
44	5226A NAA: JH837	Import from Southern Palestine	Group B3	Undetermined northern Levant	–
45	5226B NAA: JH838	Most similar to Tell el-Dabʿa MB072, of uncertain provenance	Group B3	Undetermined northern Levant	N.D.
46	5709 NAA: PMG124	Import from Southern Palestine	Group B3	Undetermined northern Levant	–
47	5816 NAA:PMG131	Most similar to Southern Palestine	Group F	Mount Carmel region	–
48	5822Q NAA: JH696	no matches	Group B1	Northern Lebanese coast (north of Tripoli)	N.D.
49	5824 NAA:PMG123	Import from Southern Palestine	Group B2	Northern Israel or the L:ebanese coast	–
50	5826 NAA: PMG117	Import from Southern Palestine	Group B1	Lebanon east of the coast line Beirut-Byblos	–
51	5827 NAA:PMG118	Import from Southern Palestine	Nile Sediment	Nile Valley	–
52	5828 NAA:PMG119	Import from Southern Palestine	Group B2	Northernmost Israeli coast or the Lebanese coast	–
53	5894 NAA: PMG120	no matches	Group A1	Northwestern Syria: Ugarit, ʿAmuq area or the Cilician coast	N.D.
54	5894C NAA: PMG121	most similar to Tell el-Dabʿa PMG126	Group B1	Northern Lebanese coast (north of Tripoli)	N.D.
55	6114E NAA: MB029	Import from Southern Palestine	Group B3	Undetermined northern Levant	–
56	6114L NAA:MB032	Egyptian Nile alluvium	Nile Sediment	Nile Valley	+
57	6115G NAA: MB015	Most similar to Tell el-Dabʿa JH781, of uncertain provenance	Group E	Eastern Galilee or the Yarmuq area, or the Akkar or Middle Orontes north of Qedesh	N.D.
58	6115Y NAA: MB018	Import from Southern Palestine	unclassified	unknown	N.D.
59	7029A NAA: PMG105	no matches	Group D	Lebanon east of the coast line Beirut-Byblos	N.D.
60	K411 NAA: JH002	most similar to Sirkeli AGSR 23 uncertain provenance	Group A1	Northwest Syria or Cilicia	+
61	K0478 NAA: PMG107	Import from Southern Palestine	Group B3	Undetermined northern Levant	–
62	K2567 NAA: PMG111	Import from southern Palestine	Group G	Central coast of Israel	?
63	K2574 NAA: PMG 114	Most similar to Tell el-Dabʿa JH859, which is most similar to Tell el- Hesi DRPA44, of local origin	Group B2	Northernmost Israeli coast or the Lebanese coast	N.D.
64	K2574 NAA: PMG115	no matches	Group B2	Northernmost Israeli coast or the Lebanese coast	N.D.
65	K2771 NAA: PMG106	most similar to southern Palestine	Group D	Lebanon east of the coast line Beirut-Byblos	–
66	K2810 NAA: JH108	Import from Southern Palestine	Group B1/2	Northern Lebanese coast (north of Tripoli)	–
67	K2810A NAA: JH111	most similar to Egyptian Nile alluvium	Nile Sediment	Nile Valley	+
68	K3456 NAA: PMG125	most similar to southern Palestine	Group K	Northwestern Negev	+
69	K3656 NAA: PMG104	Import from Southern Palestine"	Group G	Central coast of Israel	?
70	? NAA: JH672	Fayyum-Maadi marl clay	Group D	Lebanon east of the coast line Beirut-Byblos	–

* sorted according to basket numbers

Table 3 Comparison between NAA and petrographic results (sorted according to basket numbers)