

A Ceramic Sequence for Northern Jordan: An Archaeological and Chemical Perspective

Four seasons of excavation (1990-1993) at Tall al-Fukhār in northern Jordan have yielded a rich, diverse collection of Bronze and Iron Age pottery and silicate artifacts (also see J. Strange, this volume). This corpus is particularly important for the archaeology of Jordan, because it constitutes the first long-term stratified sequence from this region.

A review of the primary stylistic and technological features of the pottery and silicate artifacts from the main periods sets the stage for materials analyses that reveal local industrial developments and the foreign relations of Tall al-Fukhār. The methodology follows that which is outlined and used in a series of publications (e.g., McGovern 1986, McGovern 1989a and 1989b, James and McGovern 1993, and McGovern, Fleming and Swann 1993; also see McGovern 1995a). In brief, technology and style are viewed as interacting variables in their larger cultural and environmental contexts, and are reconstructed from the archaeological record using the appropriate techniques in conjunction with relevant contemporaneous literary and pictorial evidence and ethnoarchaeological analogy.

Ceramic Overview¹

The earliest occupation of the site is represented by only a few sherds of Early Bronze (EB) IB band-slip/grain-wash ware. The subsequent nine phases of EB II-III, however, yielded pottery types that are comparable to those of EB Palestine generally, including bowls, large and small jars, juglets, and amphoriskoi. Except for more careful execution of patterned burnishing, painting, slipping, and combing on EB II vessels, the forms and other stylistic details of the vessels show marked uniformity throughout the period. The bodies of the larger vessels were usually built up of coils, although several examples had been thrown. Necks and rims were often finished on a tournette. Firing appears to have been carefully done, although thick black cores of unburnt carbon are the rule. One bowl sherd of Khirbat al-Karak ware, with a polished red interior and black exterior, was found in an EB III context.

After a probable gap in EB IV, Middle Bronze IIA is represented by a burial of probably two adults (male and female), in which three whole vessels, viz., a globular jar, platter bowl, and carinated bowl, had been deposited. All were thrown on a wheel. The absence of slips, the employment of irregular hand-burnishing or more careful wheel-burnishing in the case of the carinated bowl, relatively unstable disc bases (string-cut off the wheel), and specific stylistic features point to the vessels belonging to an early phase of MB IIA. Handmade, flat-bottomed cooking pots of the standard MB IIA type, with a finger-impressed ledge below the rim, were found in associated contexts. Levantine Painted Ware, employing simple bichrome geometric designs, is also represented in the group.

The Late Bronze (LB) Age, a transitional Late Bronze/early Iron, and Iron IB are among the best attested periods at Tall al-Fukhār. To date, however, only a few sherds of Chocolate-on-White ware and of other characteristic pottery types indicate reoccupation of the site in LB IA, following a hiatus in MB IIB-C.

The repertoires of LB IB-IIA and IIB pottery include most of the types that are documented elsewhere in Palestine and Jordan (for comparable material from the al-Baq'ah Valley and Bayt Shān, see McGovern 1986 and James and McGovern 1993). Of particular interest are several handleless collared-rim jars or pithoi (exceeding 1 m in height) of an early type with a rope appliqué at the upper mid-body, which also occurs at LB IIB Hazor and Bayt Shān (compare Yadin, *et al.* 1960: pl. 129.2 and James and McGovern 1993: II FIGS. 14.2 and 32.4). The "collar" at the juncture of the neck and shoulder is most often the lower terminus of a coil or rarely a separately applied coil. Oblique notching on the collars is rarely used to indicate rope decoration. The cooking pots were manufactured by applying one or more clay coil to a mold-made body; the coil(s) were folded back and forth to produce two rim types, either the common flaring triangulated form, or, more commonly at Tall al-Fukhār, an upright form with a slight gutter on the interior and two ridges on the exterior.

¹ Space limitations preclude presenting the detailed results here. A full discussion, with pottery descriptions, NAA data and statistical evaluation, is to

be published in a monograph on the first four seasons of the excavation, (in preparation).

In other respects, small- and medium-sized vessels are generally made on the wheel, but a shift to more hand-built vessels is already apparent in the separately applied coils for ring bases of bowls and the interior or exterior development of krater rims. Bichrome and monochrome painted decoration, rarely over white slips, are fairly common, especially on kraters, jugs, and pilgrim flasks. In addition to the usual simple horizontal straight and wavy bands, metope-triglyph designs occur.

Sherds of several Mycenaean IIB vessels, probably from jars and especially *kylikes*/cups, were recovered from the large public building "palace". A fragment of a Cypriot White Slip II "milk" bowl came from a mixed context.

The "palace" also yielded a unique blue-green glazed pottery "knob" (FIG. 6, J. Strange, this volume), possibly used as a wall decoration (attested at Nuzi in northern Mesopotamia in the 15th c. BC—compare Starr 1939: 408, pl. 98A) or an ornamental finial, a fragment from a blue-green glazed pottery jar or bottle, a glass female figurine pendant (FIG. 7, J. Strange, this volume) that is among the earliest molded glass artifacts ever made (McGovern 1986: 30, type II.B.1.a), and a blue-green glazed faience bottle and bowl. In general, the silicate artifacts are dated to LB I, predating the final use and destruction of the building, so that they must be heirlooms.

The Late Bronze-Early Iron transitional phase is characterized by numerous collared-rim jars and cooking pots. The collared-rim jars now have lower necks, more elongated bodies, and two relatively small loop handles at the upper mid-body. Evidence of coil manufacture is very clear from the impressions of ropes applied horizontally every 5-6 cms to hold each coil during the drying process, the next lower coil having been smeared over the top of the one added above it. As in the preceding LB IIB period, the cooking pots were manufactured by applying one or more clay coil to a mold-made body. Folding and subsequent shaping, sometimes using a sharp-pointed instrument or turning, now has resulted in a profusion of rim types, clearly related to what has gone before but more ridged and grooved and sometimes more inturned than the LB IIB prototypes.

Monochrome red painting, sometimes on a white slip (occasionally irregularly hand-burnished), predominates. A greater variety of designs than in LB II, albeit more poorly done, are attested, including filled triangles, criss-crossed lines, concentric circles on pilgrim flasks, figural designs including palm tree and the unique side and top views of a highly schematic bird on either side of a pilgrim flask, etc. One Philistine sherd (FIG. 9, J. Strange, this volume) that belongs to a type derived from a Mycenaean drinking vessel, the *skyphos*, had a well-executed looped spiral in black paint on a white slip (compare Dothan 1982: 98-106, Fig. 2, pl. 2).

The ensuing Iron IB level, which may date as late as

1050 BC in Jordan (see McGovern 1986: 9), is marked by collared-rim jars of LB/early Iron types which were evidently recycled as ovens by cutting off their bases and burying the necks of the vessels upside-down in the ground. Often two jars were used, one inside the other, with a stoking hole broken through the sidewalls. Medium-sized vessels, including jugs, juglets, and bowls, are generally coil-built; only small bowls and lamps are thrown off-the-hump. Cooking pot types are difficult to distinguish from LB/early Iron varieties. Painted decoration decreases, but coil appliqué on vessel exteriors and rows of reed impressions, especially on loop handles, are popular.

Following an apparent hiatus of occupation from Iron IB through IIB, the pottery repertoire of the Iron IIC-Persian period (ca. 650-400 BC, although likely continuing down to the Hellenistic times), which is primarily associated with silos covering a large area of the tell, is remarkably similar to that found in the 'Ammān region (McGovern 1983). Vessels are generally made on the wheel, including cooking pots, and probably fired quickly to a high temperature, leaving a carbon core. A ridge, forming a groove below the rim on bowl and krater exteriors and along the top of everted cooking pot rims, however, was achieved using a coil; ring bases could also be made by adding a coil. Decoration includes very fine wheel-burnished red slips on bowls and monochrome and bichrome horizontal bands, sometimes over a white slip, on jugs and kraters. Several Cypro-Phoenician sherds of late type have brown or black painted horizontal bands and concentric circles applied over a hand-burnished surface.

Ceramic Analyses

Neutron activation analysis (NAA) of 98 sherds for the main periods reviewed above, including 20 of the Hellenistic date, have revealed that pottery was produced locally in the vicinity of Tall al-Fukhār and imported from several regions of the Eastern Mediterranean. The physicochemical method of NAA has been extensively employed in pottery provenience studies, because of its sensitivity and precision in measuring as many as 35 elements, including rare earths which often characterize a clay source, and because it requires very small samples (50-200 mg) that are non-destructively analyzed (for analytical procedure and references, see James and McGovern 1994).

Relating the chemical composition of a particular ancient pottery sample to a given clay source, thereby "fingerprinting" the pottery and its presumed place of manufacture, is based on what has become known as the Provenience Postulate. Briefly, the assumption is made that the chemical variation within a given clay source is less than that between different sources. A native clay, however, was often modified by the ancient potter. Inorganic aplastics (temper) or organic materials might be added to the clay body, to improve its workability, drying and firing properties, and functionality. If these inclusions

are relatively "pure" (e.g., quartz, calcite, or straw), the diluent effect on the chemical composition of an ancient sample will be spread across the range of elements and correction factors (e.g., least-means fitting) can be readily applied. The addition of complex heavy minerals, which can unpredictably enhance or diminish certain elemental concentrations, are less easily corrected for statistically.

A range of univariate and multivariate algorithms — means and standard deviations, and correlational, clustering, and principal components analyses of a range of elements — are used to define local chemical groups of ancient pottery, with widely divergent samples (outliers) being excluded. Archaeological and geological criteria are important in refining and testing these groups, whether well-dated pottery types, clays from specific geochemical regimes, clay beds within a single deposit, etc. For example, cooking pots, as well as walls and kilns of mudbrick (sunbaked clay), are often made of local clay and are not transported to another site. The NAA analyses of such samples should then serve to confirm a hypothesized local group based on other pottery types. This approach is essential when an ancient clay source has been totally exploited or systematic clay sampling has not yet been carried out in a region.

In general, our Old World data bank has excellent temporal and spatial coverage of the Levant and Egypt (approximately 2700 samples from 150 sites), together with other regions of the Near East and Mediterranean, including the Sudan, Greece, Iraq, Iran, and parts of Turkey. Tall Abū al-Kharaz, Tall as-Sa'idiyya, Kataret as-Samrā', Pella and Jericho in the Jordan Valley, Khirbat Umm ad-Danānir and Rujm al-Henu (West) in the al-Baq'ah Valley, the 'Ammān Citadel, Bāb adh-Dhrā', and aṣ-Ṣāfi are among the Bronze and Iron Age sites in Jordan for which material has been analyzed. This wide areal coverage, coupled with large numbers of samples for locally defined groups, enable us to apply powerful multivariate statistics in determining the archaeological origin of the pottery from Tall al-Fukhār. The clays included in the data bank date from the Lower Cretaceous period to recent times and derive from deposits throughout the Levant (e.g., the red loess clays of the southern Palestinian coastal region, the yellow limestone-derived clays of the Palestinian hill country, and Jordanian smectites and kaolin clays).

It is quite common for the elements in clays and minerals to covary with one another. For example, the high correlation ($r > 0.99$) of iron (Fe) and scandium (Sc), both trivalent ions of about equal size, in nature is well known. Univariate statistics can be very misleading if this relationship goes unrecognized. If the variance-covariance matrix for many elements of a presumed local group is calculated, however, a new set of standardized orthogonal coordinates (eigenvectors) can be defined in multi-dimen-

sional Mahalanobis space that takes advantage of elemental correlations. For statistical calculations, oxide data are also converted to logarithms, since many chemical elements appear to be lognormally distributed in nature, and are also standardized by this procedure. The Mahalanobis distance of a given sample from the origin or centroid of the group is directly related to the probability of the group membership of that sample, assuming a multivariate normal distribution. With high correlations between many elements, such as is characteristic of Levantine clays and pottery, it is possible to achieve extremely good results. A Mahalanobis probability above 5% for a sample tested against a group with a high sample number to variate ratio is a strong guarantee that it belongs to that group.

One of the most significant results of the NAA study of the Tall al-Fukhār pottery² is that the largest group, representing every major period, was produced somewhere in the vicinity of the site, since the group is very close chemically to alluvial clay deposited in the Wādī ash-Shallāla below the site. This result is also substantiated by preliminary petrographic analysis. The overwhelming majority of the EB II-III pottery tested (13 out of 21 samples) is of local origin, including bowls, jars, jugs, and holemouth cooking pots. Two jars with well-executed pattern burnishing and an EB II bowl that had been tournette-burnished along the rim and highly polished by hand elsewhere were of uncertain provenience, as was the Khirbat al-Karak sherd (cf. Chazan and McGovern 1984, *re* local production in the Jezreel Valley). Six of 9 MB IIA vessels analyzed were of local origin, including cooking pots, jars (one whole vessel from the burial—above), and a Levantine Painted Ware sherd. For LB IIB, a red-painted cylindrical stand fragment, cooking pots, and a range of macroscopically different wares were produced locally.

During the Late Bronze/early Iron transition, a pyxis and possibly the pilgrim flask with the unique painted bird design (above) are of local origin. In Iron IB, of the few examples tested, only a cooking pot was made locally. It should be noted that all except one collared-rim jar of transitional LB/early Iron and Iron IB date are of uncertain origin, suggesting that they were imported into Tall al-Fukhār from a region not well represented in the data bank (for the one exception from southern Palestine, see below). The pattern of primarily local production is again evidenced for cooking pots in the Iron IIC-Persian period. The three Cypro-Phoenician sherds, which were available for analysis, are of uncertain origin. Although not reviewed above, the Hellenistic pottery corpus retains many of the technological and stylistic features of the Iron IIC-Persian repertoire. Correspondingly, 9 out of 20 Hellenistic storage jars, jugs, and a cooking pot and bowl are of local origin.

The main source of pottery imports to Tall al-Fukhār from MB IIA through the end of the Iron Age was southern Palestine, *viz.*, the Gaza region, extending along the

² See n. 1.

coast north to Ashkelon and as far inland as Tall Bayt Mirsim, which is chemically characterized by its red loess clays (for a more extended discussion, with data, see McGovern *et al.* 1994). This finding stands in marked contrast to the lack of imports from this region in EB II-III.

The pottery types for each main period imported from southern Palestine are as follows:

- (1) MB IIA – cooking pot and jar/goblet
- (2) LB IIB – cooking pot
- (3) Iron IB – collared-rim jar and Philistine bowl
- (4) Iron IIC–Persian– cooking pot, bichrome–painted jug, undecorated bowl, and wheel– burnished red–slipped bowl
- (5) Hellenistic– two cooking pots, red–slipped bowl, and alabastron

Pottery of special types were clearly being imported from the Gaza region. The prevalence of cooking pots is more difficult to explain, since these vessels have generally been considered as more intransigent to technological change, due to their association with traditional cuisine, and thus tied to local household and/or village production. The NAA data from Tall- al Fukhār, however, suggests that cooking pots were produced on a larger scale and distributed to other regions of Palestine from workshops in southern Palestine, at least during the periods represented at Tall- al Fukhār. Alternatively, it might be argued that people from southern Palestine moved to the site, bringing their important belongings with them, or visited friends or relatives there and left the cooking pots behind. Some kind of economic activity, trading the vessels for their own sake or possibly for what they contained, is more likely, but lacking contemporaneous texts, other explanations cannot be ruled out.

Several other regions of the Levant and Egypt account for other imported pottery and silicate artifacts into Tall- al Fukhār. In LB IIB, a probable jar came from 'Affuleh in the Jezreel Valley; in the Persian period, a multiple-handled and knobbed krater was from the al-Baq'ah Valley in central Jordan (see McGovern 1986) and a red-painted jar was made of Egyptian Nile alluvial clay; and during the Hellenistic period, high quality slipped and painted bowls were imported from eastern Cyprus and storage jars from Rhodes and probably the Cilician plain of southern Anatolia.

Three Chocolate-on-White sherds from a bowl, pyxis and jar, dating to LB IA, fit the same chemical profile as other examples of this ware analyzed from Bayt Shān, Tall Abū al-Kharaz, Pella, Kataret as-Samrā', the 'Ammān Citadel, and sites in the al- Baq'ah Valley. A northern-central Jordan Valley origin is probable based on the NAA results, and accords with the high frequency of the unique ware in this region and probable wasters found at Kataret as-Samrā'. As yet, however, a clay source has not been located.

Four Mycenaean *kylikes*, which are particularly associated with wine drinking in Greece, and a probable piri-

form jar fragment were tested by NAA. Three had been produced in the Mycenae region itself in central mainland Greece. One *kylix* and the jar were of uncertain origin.

The glass of the female figurine pendant and the glazes on the pottery knob, pottery jar/bottle, and faience vessels are all of similar composition, according to non-quantitative energy-dispersive spectrometric analyses using a scanning electron microscope. The blue-green coloration, which has been extensively leached out on all the artifacts, is due to copper ions in the +2 oxidation state. Potassium oxide exceeds soda, suggesting that a plant material was used as the main flux. These results could fit with local Palestinian production (McGovern, Fleming and Swann 1993; McGovern 1986), but stylistic considerations point rather to a northern Mesopotamian origin. The NAA data for the pottery of the knob and jar/bottle sherd did not match any site or region in the data bank.

Conclusions

The stratigraphic sequence of pottery and silicate artifacts from Tall al-Fukhār, coupled with stylistic and technological analyses, provides the first long-term perspective on the Bronze and Iron Age material culture of northern Jordan, and enables this region to be integrated into broader developments of Jordan and the Levant (see, e.g., McGovern 1987 and 1995b).

The neutron activation analysis study of a wide range of pottery types from the main periods at the site shows that Tall al-Fukhār was not the isolated, uninhabited tall that it is today. Contacts were especially strong with southern Palestine from the Middle Bronze Age onwards. A local pottery industry, which had already begun in the Early Bronze Age and used alluvial clays deposited in the Wādī ash- Shallāla, continued to produce the majority of the pottery found at the site through Hellenistic times.

Specific contacts, most probably trade connections, are documented for northern Palestine, the Aegean, and Cyprus in Late Bronze IIB, central Jordan and Egypt in the Iron IIC-Persian period, and the eastern Mediterranean (Cyprus, Rhodes, and probably southern Turkey) in the Hellenistic period. Thus, Tall al-Fukhār shared in the economic prosperity of these cosmopolitan times. Some political integration with central Jordan in the Iron IIC-Persian period is possible, since the pottery types are almost identical in the two regions.

Some pottery was probably imported for its own sake, whether as drinking vessels (e.g., the Mycenaean *kylikes* and the Philistine *skyphos*) or because of traditional associations (e.g., cooking pots which were used to prepare particular foods). In case of the Philistine import, this opens the question of Sea People influence in northern Jordan (McGovern 1994). Other pottery, especially jars, probably functioned as containers for other goods, yet to be determined (see Biers and McGovern 1990; Michel, McGovern and Badler 1993).

The most important group of silicate artifacts at Tall al-Fukhār belong to LB IIB, and are probably heirlooms of 16th-15th c. BC date, near the beginnings of glassmaking in the Near East. The glazed pottery artifacts are particularly unusual, only a few other examples being reported from LB Palestine (for Bayt Shān, see James and McGovern 1993). The molded glass female figurine pendant, the forms of the faience vessels, and a unique glazed pottery "knob" suggest an origin in northern Mesopotamia, but the chemistry of the glazes and neutron activation analyses of the pottery of the glazed pottery artifacts do not provide a definitive answer.

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