

4. Archaeological Material

The majority of samples examined during this study consisted of sherds or broken vessels of pottery identified as RLWm ware by archaeologists in the field or by museum specialists. Some samples were excavated recently; others had been in museum stores for many years. In some cases it was impossible to obtain any information about how the material had been cleaned, conserved or stored before arriving for analysis. Most sherds had been stored for long periods of time in plastic bags resulting in the contamination of many residues with phthalates (see chapter 7, p236-238). Three visible residues were also analysed.

An attempt was made to examine samples from as many sites as possible across the eastern Mediterranean. Each major region in the area (Cyprus, Turkey, Egypt and Syria/Palestine) is represented by at least one site, although there were many difficulties in obtaining material from some areas and some sites are represented by only one sherd. The sherds analysed are summarised in table 4.1 (p109).

4.1 Sherd material

The 72 sherds (60 RLWm ware and 12 in local fabrics) analysed for residues during this study were obtained from museum collections and from stored collections of excavation finds. In addition two sherds were received but could not be analysed as they were too small (see below p84, 90 and table 4.1).

They had all been stored under different conditions in different parts of the world and in many cases the storage conditions are unknown. However where this information was available it has been recorded in an attempt to create a clearer picture of how post-excavation storage may affect absorbed residues in pottery.

Sherds were analysed from eight LBA sites on Cyprus: Arpera, Dhenia, Enkomi, Hala Sultan Tekke, Kalavastos-*Ayios Dhimitrios*, Kazaphani, Kouklia and Myrtou-*Pigadhes*. Material was also available from two Hittite sites in Turkey – Boğazköy and Kuşakli, and one site in Syria – Tell Tweini. Further analysis was also carried out on six sherds from three sites examined during an earlier study (Steele, 2004; Knappett *et al.*, 2005). These sites were Kouklia in Cyprus, Kilise Tepe in Turkey and Memphis-Saqqara in Egypt (see table 4.1).

4.1.i Cyprus

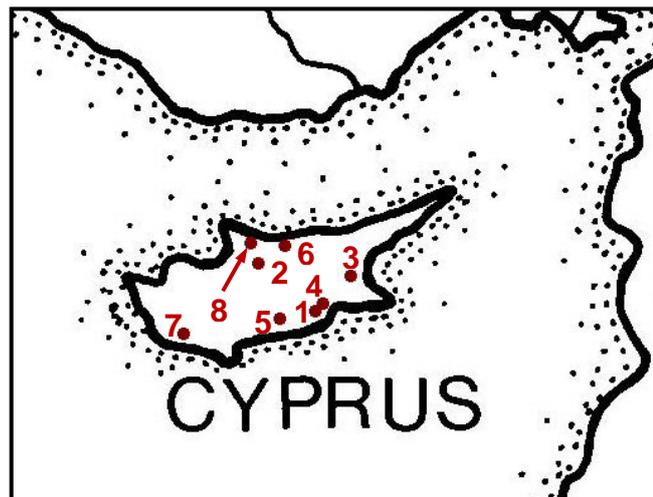


Figure 4.1: Map of Cyprus showing sources of sherd material (after Eriksson, 1993, fig. 1 and fig. 8). Key: 1 – Arpera, 2 – Dhenia, 3 – Enkomi, 4 – Hala Sultan Tekke, 5 – Kalavastos-*Ayios Dimitrios*, 6 – Kazaphani, 7 – Kouklia (Paleopaphos), 8 – Myrtou-*Pigadhes*.

4.1.i.a Arpera

Excavations in the late 19th and early 20th centuries revealed rich LBA tombs at Arpera (fig. 4.1) (Steel, 2003). Markides excavated approximately 10 intact tombs in 1914 but these were poorly recorded (Keswani, 2004, 187). Field walking and further excavation under the auspices of the Department of Antiquities during the 1990s discovered another LC tomb and a scatter of LC pottery probably connected to the LBA settlement (Leonard, 2000; Steel, 2003; Keswani, 2004, 187). Large quantities of copper slag found on the surface near utility trenches point to the presence of metal working facilities and an involvement in the important copper production industry which provided much of the wealth of Cyprus during the LBA (Steel, 2003). Surface deposits of Middle Cypriot (MC) pottery also found during the 1990s indicate that the site was not newly occupied during the LBA (Steel, 2003).

Ten sherds were available for analysis from Arpera, made available for this study from the Cypriot collection at the Ashmolean Museum in Oxford, UK (Inventory numbers 1953.1159a, t, c, d, 1953.1161b, 1953.1162b, c, d, e and f; numbers 1 – 10 respectively for this study; see table 4.1 for details). Åström listed 1953.1159c as coming from Hala Sultan Tekke (Åström, 1972, 203) and Eriksson's catalogue reproduced this error (Eriksson, 1993, 173ff). However an inspection of the sherds reveals that they have their site of origin written on them with the inventory number making it obvious which site they should be ascribed to. There is very little information about the exact provenance of this material except that it is definitely LBA in date and most sherds were surface finds (Sherratt, pers. comm.). The collection was catalogued in 1953 so was

collected at some point prior to this. Until early in 2005 this material was stored in cardboard boxes in the Museum stores, although there is no record of how it was stored in the past or what post-excavation treatment had been applied. However, when the material was collected in May 2005, the sherds had been placed in individual plastic bags with a sheet of plastic foam.

Three of the sherds are the bases of spindle bottles, all three with different pot marks inscribed on the base (sherds 1, 2 and 3) (figs 2.8, 4.2 and 5.2). Also included are the base of a larger vessel, possibly a spindle bottle, with a pot mark inscribed on the base (sherd 4) (fig. 4.3); three highly curved sherds, either spindle bottle necks, the lower part of very small spindle bottles or very small arms (sherds 8, 9 and 10) (fig. 4.4); a body sherd from a spindle bottle including the base of the handle (sherd 5) (fig.5.2) and a body sherd from a pilgrim flask (sherd 6) showing the typical curved throwing marks characteristic of pilgrim flask sherds as described in chapter 2 (p30-31) (figs 2.6 and 2.7). The final sherd (sherd 7) is probably from a pilgrim flask, showing similar markings to sherd 6.

All the sherds are classic, fine RLWm ware, usually with some burnished surface remaining on the outside. The interiors of the spindle bottle bases (sherds 1, 2 and 3) and of sherd 8 are encrusted with a white deposit (fig. 5.2), probably from a lime rich burial environment (see chapter 5 for a further note on this deposit, p125-126) and some signs of the same deposit are also present on the exterior surfaces.

A portion of sherd 3 had been removed by drilling and, although no documentation was available, it appears that this was for NAA analysis (Sherratt, 2005, pers. comm.).



Figure 4.2: Sherd 2 from Arpera, Cyprus showing the pot mark inscribed on the base.

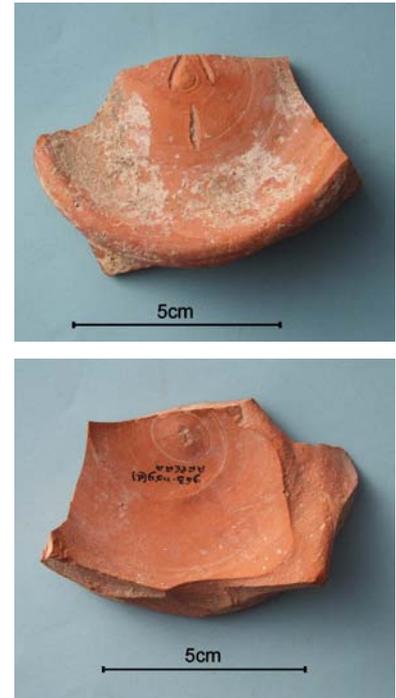


Figure 4.3: Sherd 4 from Arpera, Cyprus showing the pot mark inscribed on the base

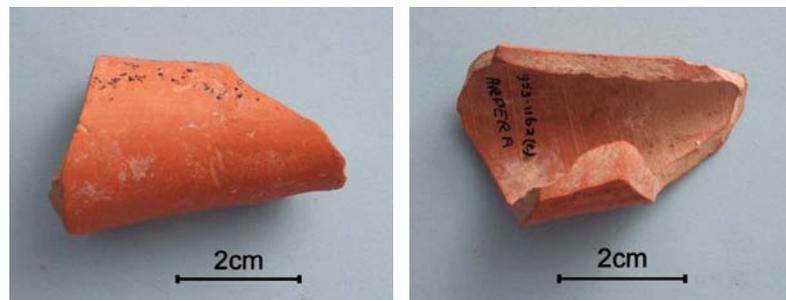


Figure 4.4: The exterior (left) and interior of sherd 9 from Arpera.

4.1.i.b Dhenia

The site of Dhenia (or Deneia) (fig. 4.1) is significant for its extensive Bronze Age cemetery but was used continuously as a burial site from the preceding Philia period right through the Bronze Age (Karageorghis, 1982, 41; Webb & Frankel, 1999; Keswani, 2004, 86; Frankel & Webb, 2007, 1). However only a small number of tombs have been excavated and published (Frankel & Webb, 2007, 1), for example those published by Åström and Wright (1962), Nicolaou and Nicolaou (1988) and Hadjisavvas (1985). Stewart collected pottery from eight tombs during the 1930s (Frankel & Webb, 2007, 1) and Catling collected approximately 300 pieces during 1953 which are now in the Ashmolean Museum (Åström & Wright, 1962; Frankel & Webb, 2007, 1). More recently, in 2002, a small trial geophysical survey was organised by Iacovou from the Archaeological Research unit at the University of Cyprus and conducted by Sarris. In 2003 surveys were carried out by a team led by Frankel under the auspices of the Department of Antiquities which documented the position and nature of all the visible tombs (Frankel & Webb, 2007, xxv). However excavations in 2004 were seriously and permanently curtailed due to an outbreak of typhus (Frankel & Webb, 2007, xxv). There has been, and continues to be, a significant problem with tomb looting at this site (Åström & Wright, 1962; Deftereos, 2007; Frankel & Webb, 2007, 3-4)

Use of the cemetery at Dhenia was at its peak during the Middle Cypriot period and into LCI-II with the latest systematically excavated tomb dating to LCIII (Frankel & Webb, 2007, 1). The location of the settlements which were served by this cemetery remains uncertain (Frankel & Webb, 2007, 1). There is

evidence for later occupation during the Iron Age but it is not clear whether the site was occupied continuously across the LBA/Iron Age transition (Frankel & Webb, 2007, 1-2).



Figure 4.5: Pilgrim flask sherd from Dhenia, Cyprus.

One sherd was available from the site of Dhenia. This is the neck, handle and part of the upper body of a pilgrim flask (fig. 4.5) made available from the Cypriot collection at the Ashmolean Museum (Inventory number 1953.870) (table 4.1). This piece is listed as one of the fragmentary pilgrim flasks which Catling acquired from Dhenia for the Ashmolean Museum in 1953 and is recorded by inventory number in Frankel and Webb (2007, 98). Åström & Wright (1962) record that this material came from the Mali and Kafkala areas of

the site and was collected from looted tombs during 1951-1953 by Catling. Åström also records the Ashmolean inventory number as belonging to a RLWm ware pilgrim flask from Dhenia (Åström, 1972, 203). The Museum catalogue number indicates it was catalogued in 1953 although the numbers 2/52 are written on the inside surface which could imply a collection date in 1952. However no further information is available as to the exact provenance of the sherd (Sherratt, pers. comm.). The sherd had been stored in the Ashmolean Museum in the conditions described in the previous section. A pot mark is present at the base of the handle (fig. 2.8). The fabric is fine, red, with rare, very small (<1mm in length) inclusions and voids. The outside surface is worn and vertical marks from the burnishing process are visible on the neck of the vessel. The neck has obviously been constructed separately and joined to the body later.

4.1.i.c Enkomi

Enkomi on the east coast of Cyprus is one of the most important and extensively excavated LBA sites on the island (Karageorghis, 2002, 57) (fig. 4.1). Excavations started in 1896 and by 1969 about 180 tombs and associated features had been uncovered (Keswani, 2004, 93). The first systematic excavations were carried out under the direction of Dr A. S. Murray during the late 1890s (Schaeffer, 1948). A Swedish expedition under the direction of Gjerstad restarted work at the site in 1930 (Gjerstad, 1934, 467-575). These early excavations concentrated on tombs and the English and Swedish researchers uncovered about 120 tombs from the Middle and Late Bronze Age.

In 1934 Schaeffer discovered the settlement served by these tombs (Schaeffer, 1948, Schaeffer, 1952), returning after a break in 1946 to continue excavation of the city (Schaeffer, 1948; Schaeffer, 1952, 83ff). The Cypriot Department of Antiquities also carried out excavations from 1948-1958 under the direction of Dikaios (Dikaios, 1969-1971).

Enkomi had been inhabited during the Middle Bronze Age (MBA) but was abandoned towards the end of the MBA (Schaeffer, 1948). After the re-establishment of the settlement during LCI it became a cosmopolitan industrial centre, reaching the height of its wealth and prominence during LCII (Schaeffer, 1948). This great wealth accumulated during this period was generated by involvement in the copper industry and foreign trade both of which expanded dramatically during the LBA (Karageorghis, 1982, 62; Karageorghis, 2002, 11; Keswani, 2004, 84; Steel, 2004, 152, 156, 158). A fortress; rich tombs; domestic architecture; evidence of metal working – workshops, tools, moulds for copper objects, furnace and crucible fragments – and abundant copper slag; sanctuaries and evidence of the Cypro-Minoan script have all been excavated, along with a new city wall constructed about 1200BC following a catastrophic fire (Åström, 1972, 20-27, 38-40; Karageorghis, 1982, 65, 68-69, 78, 80; Karageorghis, 2002, 17-18, 27, 55, 57, 91, 95-104; Keswani, 2004, 93-98; Steel, 2004, 167-168).

The Ashmolean Museum collection contained two sherds from Enkomi (Inventory numbers 1953.1162m and 1953.1162n) (table 4.1) which were suitable for analysis (fig. 4.6). Åström records 1952.1162m in his list of

fragmentary or unpublished sherds as being in the Ashmolean but gives no site information; no information was available about the exact provenance of either sherd (Sherratt, pers. comm.). Both sherds are classic, very fine RLWm ware fabric with few inclusions and very few voids when examined using a hand lens. Both have a good lustrous surface remaining on the outside. Sherd 1 is a sherd from the area of a spindle bottle where the neck and body join: sherd 2 a very small body sherd from a vessel of unknown shape. The inside surface of sherd 2 is almost completely covered with writing. An attempt was made to avoid this when sampling the interior surface.



Figure 4.6: The interior and exterior of (a) sherd 1 and (b) sherd 2 from Enkomi, Cyprus.

4.1.i.d Hala Sultan Tekke

Hala Sultan Tekke is located on the south coast of Cyprus (fig. 4.1) and was another of the new cosmopolitan urban centres of the LBA (Karageorghis, 1982, 62; Karageorghis, 2002, 22). Interest in the site began during the late 19th century with excavations by the British Museum in under Walters in 1897 and Crowfoot in 1898 (Åström, 1976; Bailey, 1976). However these excavations were never published and only fragmentary notes and finds were generally divided up and sent to different locations or even discarded (Åström, 1976; Bailey, 1976). Karageorghis excavated two tombs at Hala Sultan Tekke in 1968 (Karageorghis, 1976) and excavations resumed in 1971 under Åström (Åström, 1976a; Åström, 1976b). Excavations have continued into the 21st century under the direction of Åström and others including Envig, Hult, McCaslin, Öbrink and Nys, and have been published in a series of Studies in Mediterranean Archaeology (Hala Sultan Tekke volumes 1-12). The settlement is situated on the shore of the Larnaca Salt Lake, which was open to the sea in the LBA, and had its own harbour on the lake (Karageorghis, 2002, 110) and flourished during LCIIIC and LCIIIA periods (Karageorghis, 2002, 110). Extensive evidence of involvement in metallurgy has been found from these periods including copper slag, tuyères, moulds for casting and bronze objects (Karageorghis, 2002, 110). Balls of clay inscribed with Cypro-Minoan characters have also been discovered, although their significance and use is unknown (Karageorghis, 1982, 65). International trade is evidenced by the presence of pottery and other goods from Egypt, Turkey, the Aegean and the Levant found in considerable quantities in both domestic contexts and tombs (Åström *et al.*, 1976; Karageorghis, 2002, 110; Steel, 2004, 156). RLWm ware

is found in relatively large amounts at this site – Eriksson (1993, 173ff) catalogues over 1,000 pieces.

Two collections of sherds, 13 in all, were analysed from Hala Sultan Tekke (table 4.1). Six samples of classic RLWm ware were supplied by Paul Åström and came from the fill of an LBA well (Öbrink, 1983). The sherds were found in features F1 and F2; F1 being a deposit composed of pottery and stones at the top of the well fill and F2 being the layer immediately below this (Öbrink, 1983, 16, 36 – figs. 17 and 18). It is not possible from the descriptions given in Öbrink (1983, 24) to determine the exact sherds which comprise these six samples and only a small selection of the 398 RLWm ware sherds from F1 and F2 are illustrated (Öbrink, 1983, 34, 45, 47). Thin section analysis and NAA confirmed that all six sherds were classic, fine RLWm ware fabric. (Knappett *et al.*, 2005). Sherd 5 is from a pilgrim flask and sherds 1, 2 and 4 are body sherds from unidentified forms. Sherds 3 (fig. 4.7) and 6 (fig. 4.8) both show pronounced changes in curvature and appeared to be from the shoulder or the join between the neck and body of a closed shape, the side/base of a bowl or a body sherd from a juglet, a shape which has a marked carination towards the base (Eriksson's form IVC3a – Eriksson, 1993, 20, 22, also illustrated in Nicolaou and Nicolaou, 1989, 68 and Plate XXII). All six sherds have very little lustre remaining on their exterior surfaces and sherd 1 shows a whitish deposit on part of the interior surface (see above, p62 and chapter 5, p125-126).

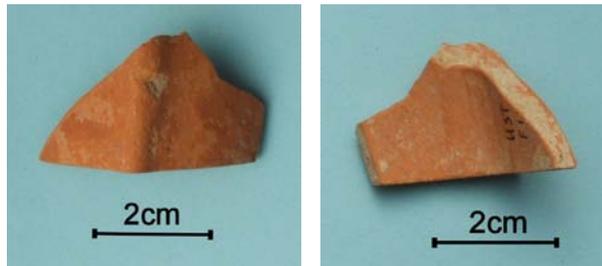


Figure 4.7: Sherd 3 from Hala Sultan Tekke, Cyprus



Figure 4.8: Sherd 6 from Hala Sultan Tekke, Cyprus

The other seven sherds were supplied from the Cypriot collection at the Ashmolean Museum (Inventory numbers 1953.1159f(?), 1953.1161e, 1953.1162g, h, i, j, l, sherds 7 – 13 respectively for this project) (table 4.1). These were surface finds collected by Catling and others over two years between 1951 and 1953 (Åström *et al.*, 1976, 59-60). They were re-catalogued by Frankel, using Catling's notes, during 1974 and this catalogue is reproduced by Åström and the sherds illustrated in his first volume on the excavations at Hala Sultan Tekke (Frankel & Catling, 1976, 65 and Plates XLII and XLIII). However in his earlier publication 1953.1162g was misattributed to Arpera and

1953.1161e to Dhenia (Åström, 1972, 203). This has caused some confusion as the mistake was perpetuated by Frankel and Webb (2007, 98) in their publication on Dhenia.

Again all these examples are of classic, fine, red fabric. Sherds 7, 8, 10, 11 and 12 were identified by Frankel and Catling as spindle bottle fragments (77, 83, 84 and 85 in their catalogue). Sherd 7 is the base of a spindle bottle with a circle incised on the base (fig. 5.2) and sherd 8 is the base of a spindle bottle handle with some of the body attached (fig. 4.9). Sherds 9 and 13 are body sherds from pilgrim flasks. The majority of the sherds still exhibit a burnished exterior surface and sherds 11 (fig. 4.10), 12 and 13 show at least traces of burnishing marks running in one direction while sherd 9 reveals traces of radial burnishing as expected on a pilgrim flask (fig. 4.10).



Figure 4.9: Sherd 8 from Hala Sultan Tekke, Cyprus

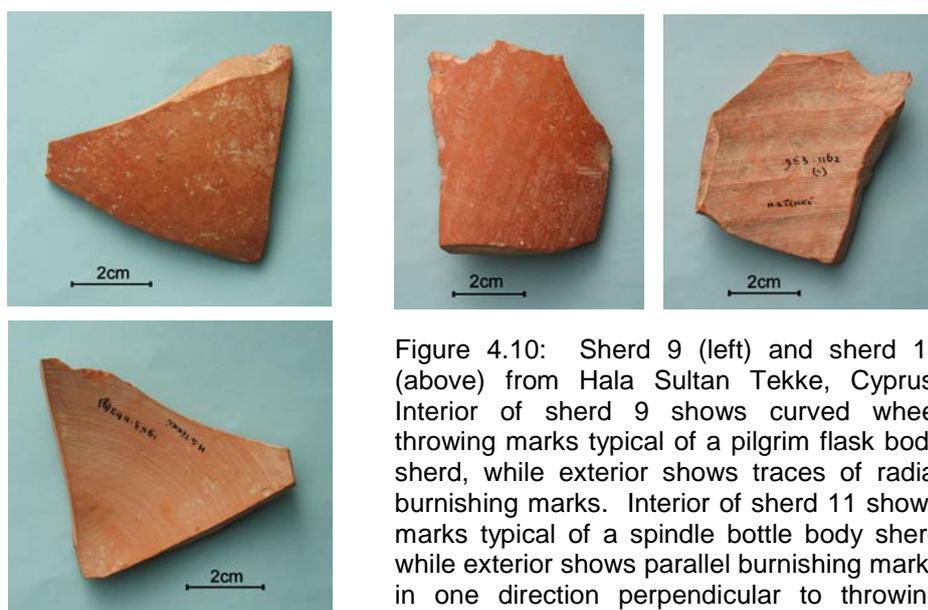


Figure 4.10: Sherd 9 (left) and sherd 11 (above) from Hala Sultan Tekke, Cyprus. Interior of sherd 9 shows curved wheel throwing marks typical of a pilgrim flask body sherd, while exterior shows traces of radial burnishing marks. Interior of sherd 11 shows marks typical of a spindle bottle body sherd while exterior shows parallel burnishing marks in one direction perpendicular to throwing marks on interior.

4.1.i.e Kalavassos

Kalavassos-Ayios Dimitrios is a large LBA site situated in the Vasilikos Valley 3.5km from the south coast of Cyprus and also near a major copper mining area (fig. 4.1). It was excavated by the Vasilikos Valley Project under the direction of Todd and South between 1979 and 1998 (South & Steel, 2007). These excavations uncovered substantial remains from LCIIA – LCIIIC, although there is also evidence for settlement from an earlier period (Karageorghis, 2002, 62; South & Steel, 2007). Publication is still ongoing in the Studies in Mediterranean Archaeology series (eg South *et al.*, 1998) and in papers and conference proceedings (eg South & Steel, 2007).

The town covered about 12 hectares and was laid out in an organised fashion with long straight streets (Karageorghis, 2002, 63). Many of the buildings are

domestic but excavation in the north eastern corner of the excavation uncovered a large ashlar building (Building X) and a surrounding complex of other structures (Karageorghis, 2002, 63; Steel, 2004, 159). Some of these buildings contained evidence of industrial scale processing of olives and within Building X itself one large room was filled with huge pithoi which probably contained olive oil and are estimated to have held at least 50,000 litres (Karageorghis, 2002, 63; Steel, 2004, 161). Other buildings within this complex yielded evidence of copper working and a collection of inscribed clay tablets in Cypro-Minoan script (Karageorghis, 2002, 17, 65; South & Steel, 2007). Building X itself may have been either a palace or an administrative centre or a combination of house and business premises (South, 2006, pers. comm.). Evidence for habitation within the building is scanty but the architectural remains suggest it may have had upper stories (Karageorghis, 2002, 63; South, 2006, pers. comm.). Four particularly rich tombs are situated around this complex, mostly constructed in the courtyards of buildings or under streets (Karageorghis, 2002, 38-42; Steel, 2004, 171-172; South, 2006, pers. comm.). The town was a wealthy, cosmopolitan centre providing evidence of many imported luxury items. It almost certainly owed its wealth to its strategic position near to both coast and copper sources (South & Steel, 2007). It was extremely prosperous from the 14th century until its abandonment about 1200BC when some areas of the town, including the Building X complex, were destroyed by fire (Karageorghis, 2002, 62-65, 73; South, 2006, pers. comm.; South & Steel, 2007).

Large quantities of RLWm ware have been uncovered at the site – 46 whole vessels and nearly 700 sherds from the area around Building X alone. Despite the large quantity this ware only comprises about 0.7% of sherds (see Appendix 2). The whole vessels include three arm-shaped vessels which are relatively rare in Cypriot contexts (South & Steel, 2007). About half of the RLWm ware sherds come from tombs, in general the same tombs where the complete vessels were found. The rest occur in non-funerary contexts around, but not in, Building X and much of this material may be from ancient tomb looting. From the site as a whole, RLWm ware only occurs in 2.7% of all contexts and, apart from the tomb looting scatters, only isolated sherds are found in domestic contexts (South & Steel, 2007). South and Steel (2007) conclude that RLWm ware was not in use in daily life at Kalavassos but was always associated with burials. This is also one site where what may be deliberate imitations of RLWm ware are found. These are in a coarse brown fabric, with the exterior surface burnished to a dull lustre (South & Steel, 2007).

Of the ten sherds available for this study three came from a context within a Building XI to the west of Building X which was probably the spoil from LBA tomb looting, and the rest from four tombs in the immediate vicinity (Knappett *et al.*, 2005; South & Steel, 2007) (table 4.1). The tombs are all high status tombs containing a range of imported goods although tombs 13, 14 and 16 had been wholly or partially looted or disturbed either in the LBA or more recently and tomb 13 had been flooded causing some disturbance (South & Steel, 2007). Tomb 11 was undisturbed and contained the remains of three young women, three infants and a child along with very rich and varied grave goods, many

imported. It is also interesting that this tomb contained a large proportion of RLWm ware – over 50% of the total pottery recovered (South & Steel, 2007) (see Appendix 2).

The sherds had been stored in the Larnaca Museum before being selected for analysis (Knappett *et al.*, 2005). The sherds are described as M50B, 24.2; M50B; 24.2, M50B, 20.2; Tomb 13, 5.1; Tomb 14, 6.3, 6.3 and 5.9; Tomb 16, 4.1 and tomb 11 sherds of brown ‘Red lustrous imitation’ and sherds of a spindle bottle (samples 1 – 10 respectively for this project) (Knappett *et al.*, 2005; South & Steel, 2007, fig. 14). Thin section analysis and NAA had been carried out on all these sherds and all except one are classic, fine RLWm ware fabric (Knappett *et al.*, 2005). Four sherds (4, 7, 8 and 10) were definitely identified as being spindle bottle fragments (Knappett *et al.*, 2005). Sherd 4 is from the shoulder of a spindle bottle, the rest are body sherds. Sherds 2, 3, 5, and 6 were identified as sherds from pilgrim flasks (Knappett *et al.*, 2005), although it is hard to determine what part of a pilgrim flask sherd 2 could have come from due to the tight curvature of the sherd combined with the direction of the wheel-throwing marks on the interior surface (fig. 4.11). Sherd 1 was identified as a body sherd “probably from a spindle bottle” (Knappett *et al.*, 2005). However it is not easy to reconcile the appearance of the wheel-throwing marks and the slight curvature of the sherd with any part of a spindle bottle and possibly this should be regarded as the body sherd from a pilgrim flask (fig. 4.12).

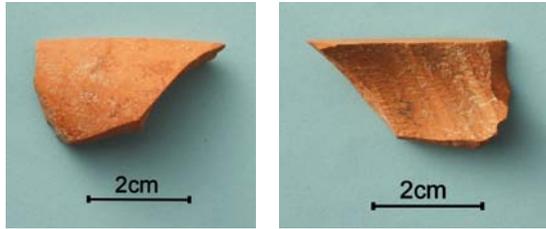


Figure 4.11: Sherd 2 from Kalavassos *Ayios-Dimitrios*, Cyprus

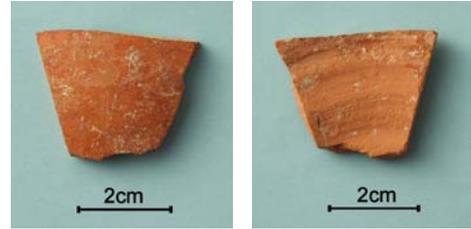


Figure 4.12: Sherd 1 from Kalavassos-*Ayios Dimitrios*, Cyprus

Sherd 9 is not RLWm ware. Although superficially similar, the fabric is different both petrographically and chemically (Knappett *et al.*, 2005) (fig. 4.13). It was considered to be a local imitation by the excavators (Knappett *et al.*, 2005; South & Steel, 2007). The condition of the sherds is very variable with some retaining their surface lustre and hard texture (eg 1, 4 and 8) (fig. 4.14) and others being worn and rather soft (eg 6, 7 and 9) (fig. 4.15). This is a feature of material from this site (South & Steel, 2007). Sherd 10 had been reconstructed and the area of the join was avoided when taking samples for residue analysis.

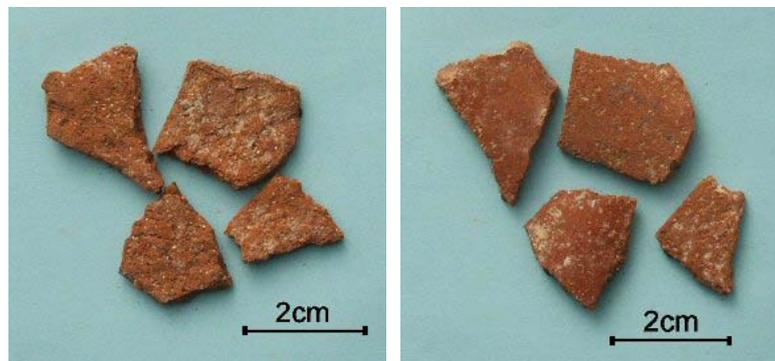


Figure 4.13: Sherd 9 from Kalavassos *Ayios-Dimitrios*, Cyprus. This sherd is not RLWm ware although the exterior surface (right) has been burnished to give a shiny finish.

Several of the sherds, most noticeably 6 and 7, show a black “deposit” on one or more surfaces (fig. 4.14). This was identified by a conservator as a crystalline mineral deposit of some kind, probably from the burial environment (O’Connor, 2007, pers. comm.).

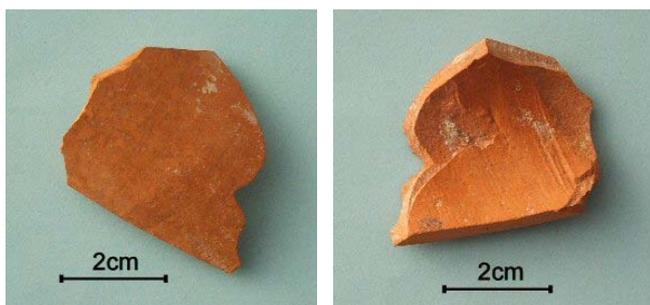


Figure 4.14: The exterior (left) and interior of sherd 9 from Kalavastos, Cyprus. This well preserved sherd produced one of the most interesting residues examined during this study (see Chapter 7).

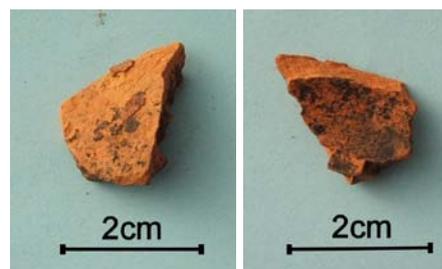


Figure 4.15: The exterior (left) and interior of sherd 7 from Kalavastos, Cyprus. This poorly preserved sherd has a flaking exterior surface and the interior surface is covered with a black deposit.

4.1.i.f *Kazaphani*

Kazaphani is about 5km inland from the northern coastal town of Kyrenia (fig. 4.1). The five sherds analysed for this study are all from Tomb 2, discovered in 1963 by workmen installing poles for overhead wires and excavated under the supervision of Nicolaou (Nicolaou & Nicolaou, 1989, 3). The tomb consists of two chambers, A and B, which share a common dromos (Nicolaou & Nicolaou, 1989, 3). The main chamber (A) was probably disturbed by looters in antiquity and had suffered a roof collapse (Nicolaou & Nicolaou, 1989, 6). Chamber B, although it had been opened in antiquity, was much less disturbed than chamber A and still retained most of the grave goods (584 of them) intact and *in*

situ (Nicolaou & Nicolaou, 1989, 6, 78). Chamber B has been dated to LCI period and the grave goods suggest that the most extensive use of the tomb was during LCIB although it continued in use certainly until the end of LCIB, possibly into LCIII (Nicolaou & Nicolaou, 1989, 78). Chamber B contained a large quantity of RLWm ware such that Kathryn Eriksson stated that, "From this chamber came the largest quantity of RLW-m ware ever recorded from one tomb." (Eriksson, 1993, 55) These included at least 44 whole or part vessels – pilgrim flasks, spindle bottles, bowls, a krater – and several collections of sherds (Nicolaou & Nicolaou, 1989, 38-74).

The sherds for this study were chosen by Carl Knappett from the collection at the Cyprus Museum, Nicosia in September 2000 (Knappett *et al.*, 2005). They are from a group catalogued by Nicolaou and Nicolaou (1989) as number 548, "Many sherds from small flasks of Red Lustrous Wheelmade Ware" (Nicolaou & Nicolaou, 1989, 38-74). They had been in storage in the Museum in a cardboard box but were then transferred to individual plastic bags. Knappett selected ten sherds for his study which included nine RLWm ware sherds and one which he identifies as a local imitation (Knappett *et al.*, 2005). All were analysed by thin section analysis and NAA before residue analysis was carried out. Five of these (sherds 1, 2, 3, 8 and 9) were sampled for residues during a previous study. Three of these contained nothing but phthalates while the other two yielded bitumen residues (Steele, 2004; Knappett *et al.*, 2005).

The five sherds examined for this study (sherds 4, 5, 6, 7 and 10) were all identified as sherds from pilgrim flasks (Knappett *et al.*, 2005) (table 4.1).

However, sherd 4 is burnished on both sides and unlikely to have been from a pilgrim flask (fig. 4.16). Several bowls and a krater are included in the catalogue of RLWm ware from Tomb 2B (Nicolaou & Nicolaou, 1989, 38-74) and these would both be possible shapes for this sherd. Sherd 5 is badly worn on the exterior and shows a pronounced change in curvature (fig. 4.17). It could be from the edge a pilgrim flask, although the change in curvature may be too small for this. The shoulder of a bottle, the base of a bowl or part of a juglet such as that shown in Nicolaou and Nicolaou's catalogue as number 44 which has a carination just above the base (Nicolaou & Nicolaou, 1989, 38-74) are also forms which possess pronounced curves such as this. Sherd 6 shows wheel-throwing marks on the interior surface but has no burnished surface remaining on the exterior and could be from any closed shape. Sherd 7, although very worn, also shows slight evidence of burnishing on both surfaces, and could be a bowl sherd. All the above are very fine, classic RLWm ware fabric (Knappett *et al.*, 2005).

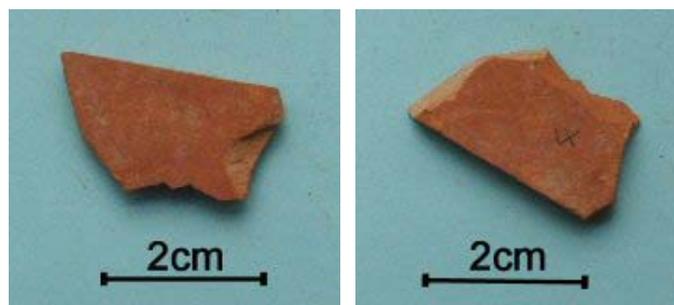


Figure 4.16: The exterior (left) and interior of sherd 4 from Kazaphani, Cyprus showing the similarity between the two surfaces.

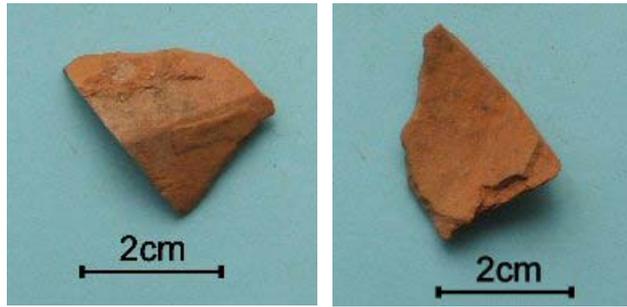


Figure 4.17: Sherd 5 from Kazaphani, Cyprus. The exterior (left) is worn and shows only remnants of the slip. The sharp corner is also visible although less pronounced on the interior surface.

Sherd 10 is not RLWm ware but, according to Knappett *et al.* (2005) is a local imitation and was not wheel-made (fig. 4.18). The fabric is, however, similar to RLWm in thin section and NAA analysis shows no significant differences between this fabric and RLWm ware (Knappett *et al.*, 2005).



Figure 4.18: Sherd 10 from Kazaphani, Cyprus. This sherd is not RLWm ware although the exterior (left) presents a colour and texture similar to a RLWm ware sherd while the interior is different in colour and finish. The sherd has been contaminated possibly with resin used for impregnating the sherd prior to cutting a thin section. These areas were avoided when sampling for residues. A small piece of metal swarf is also attached to the exterior of the sherd, presumably also from the thin section cutting procedure.

4.1.i.g Kouklia

The area around the site of Kouklia, also known as Paleopaphos, in southwestern Cyprus has yielded evidence of human occupation dating back to the Chalcolithic period (6th millennium BC) (Karageorghis, 1982, 35-36). The ruins at Kouklia were first identified by a Swiss pilgrim, Ludwig Tschudi, in 1519, and looting from the site was first described c.1540 by Etienne de Lusignan later in the 16th century (Maier & Karageorghis, 1984, 16). The first serious but unsuccessful excavations were carried out by an Italian general, Luigi Palma di Cesnola, during 1869-1870 while he was serving as the American Consul in Cyprus.

In 1888 a British excavation targeted the Sanctuary of Aphrodite, part of which was still visible above the ground. The results were inconclusive although they did discover LCIII tombs (Maier & Karageorghis, 1984, 17). F. B. Welch, a lone British traveller, excavated more tombs in 1899 but did not publish the results (Maier & Karageorghis, 1984, 17). No more work was done until 1950 when a British team under Mitford and Iliffe excavated at several locations within and around the village of Kouklia. Apart from evidence of Archaic and Classical activity they discovered a huge necropolis containing LCII-III tombs spread across three locations – *Asproyi*, *Evreti* and *Kaminia* – to the east of the modern village of Kouklia (Maier & Karageorghis, 1984, 18). The 44 tombs they excavated during 1951-1953 include one of the most sumptuous LBA burials on Cyprus (Maier & Karageorghis, 1984, 51).

Work ceased in 1955 due to increasing political instability on the island and systematic excavation did not start again until 1966. Systematic excavations then continued for 16 seasons under the direction of Maier working under the auspices of the German Archaeological Institute and the Universities of Constanz (until 1971) and Zürich (since 1972) (Maier & Karageorghis, 1984, 18-19). These Swiss-German excavations continued the work started by the British team during 1950s and also discovered extensive LBA settlement starting during LCI (Maier & Karageorghis, 1984, 51).

The Department of Antiquities also undertook a major excavation in 1979-1980 in the area of *Skales* after modern works exposed part of a cemetery. This excavation produced mainly LCIIIB and Hellenistic material (Maier & Karageorghis, 1984, 19). The excavation of two well shafts during 1967 and 1968 has added valuable information about LBA settlement at Kouklia (Maier & Karageorghis, 1984, 52-55).

It is now clear that the tombs at *Asproyi* and *Evreti* were in use continuously from LCI to LCIIIA although most LCI and LCII burials were destroyed before the tombs were re-used during LCIIIA (Maier & Karageorghis, 1984, 51-52). The LBA occupation at Kouklia started during the LCI and the site has been continuously occupied up to the present (Maier & Karageorghis, 1984, 51) (fig. 4.1). The centre of the LBA city lies under modern Kouklia and has not been systematically excavated. Evidence of metalworking is extensive and remains from ivory working, pottery production and possibly cloisonné enamelling are also present (Karageorghis, 2002, 112). Exotic goods indicate trade with the

Aegean and the Near East. The size and wealth of both sanctuary and tombs indicates that Kouklia was one of the leading cities in LBA Cyprus (Maier & Karageorghis, 1984, 50-102; Karageorghis, 2002, 112-113, 121ff). Post Bronze Age occupation has damaged or disturbed some areas of the site (Maier & Karageorghis, 1984, 52).

Red Lustrous Wheelmade ware is rare at this site, with only 22 fragments extant (Knappett *et al.*, 2005). Six of these were collected by Carl Knappett in 2000 and analysed using thin section analysis and NAA (Knappett *et al.*, 2005) (table 4.1). Three sherds (1, 4 and 6) were analysed for residues in a previous study (Steele, 2004, 52-55; Knappett *et al.*, 2005; Steele, *et al.* 2007). Sherd 4 contained very little residue, while the other two yielded a series of saturated and unsaturated fatty acids on their interior surfaces (Steele, 2004, 52-55). The residue from sherd 1 was re-examined by GC-MS during this project. The residue from sherd 6 was re-extracted and the residue sent for compound specific stable isotope analysis (GC-C-IRMS) during this study. Sherd 1 (M.PIT.5.1) came from the fill of a pit, while sherd 6 (KA 637.4) came from the area KA described below (Knappett *et al.*, 2005).

Three more sherds were also examined for residues during this study: all three are very small (<4cm²) (table 4.1). Sherds 2 (KA 464.13A) and 3 (KA 508.12A) are both tentatively identified as body sherds from spindle bottles and came from the area around the north-east gate of the LBA city among a collection of pottery which came from disturbed tombs (Maier & Karageorghis, 1984, 19; Knappett *et al.*, 2005). Sherd 2 was too small to sample for residues. This area

(KA) was occupied during LCII-III and also revealed the remains of a Persian siege mound (Maier & Karageorghis, 1984, 19). The sherds came from three separate mixed contexts containing material from LC to Roman (Knappett *et al.*, 2005). Sherd 5 (TE III 138) is from a thin-walled spindle bottle from the fill of a well in area TE dated to LCII-III (Knappett *et al.*, 2005) (fig. 4.19). All sherds are classic RLWm ware.

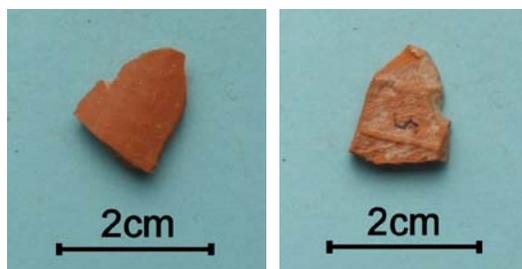


Figure 4.19: Sherd 5 from Kouklia, Cyprus. The exterior (left) shows a well preserved burnished surface while the interior exhibits wheel-throwing marks.

4.1.i.h Myrtou-Pigadhes

Myrtou-Pigadhes is a LBA site in the north west of Cyprus (fig. 4.26). After the digging of trial trenches in 1949 the site was excavated during the summers of 1950 and 1951 by an expedition jointly sponsored by the Ashmolean Museum, Oxford, UK, and the University of Sydney, Australia (Taylor, 1957). Earliest occupation discovered on the site dates to MCII and continues through to the Iron Age (Taylor, 1957, 1-25, 113-116). The first indications of buildings are from LCIA-B (Taylor, 1957, 7-10, 113-114). After the levelling of these buildings what may have been the first sanctuary was constructed during LCIIA (Taylor,

1957, 7-10, 114) and these buildings were remodelled into a new sanctuary at the LCIIIB to LCIIIC transition (Taylor, 1957, 10-18, 114). These remained in use until the destructive demolition of the sanctuary probably at the start of LCIIIA (Taylor, 1957, 23). There is also evidence for metalworking in the form of a lump of fused copper and some slag in Room 16 of the building complex adjoining the second sanctuary (Taylor, 1957, 20-21).

The Ashmolean Museum collection of RLWm ware contained one example from this site which was suitable for residue analysis (Inventory number 1963.125) (table 4.1). This is part of the body of a short spindle bottle which has been reconstructed (fig. 4.20) and is illustrated by Taylor (1957, 35) as Form 131/P469. It was excavated from Room 16 in the complex of rooms to the east of the main sanctuary (Taylor, 1957, 35). It is also listed by Taylor (1957, 117) among the pottery sent to Oxford. The fabric of this vessel does not appear to be quite the classic RLWm fine ware being more silty in appearance and containing more frequent pale inclusions and voids than is normal for classic RLWm ware when viewed with a hand lens. The exterior surface still retains some areas of lustrous finish and has the appearance of a classic RLWm ware fabric. However the interior surface is very worn and flaking. Part of the sherd has been reconstructed using glue and two areas of the interior surface have been labelled. These areas were avoided when sampling for residues.

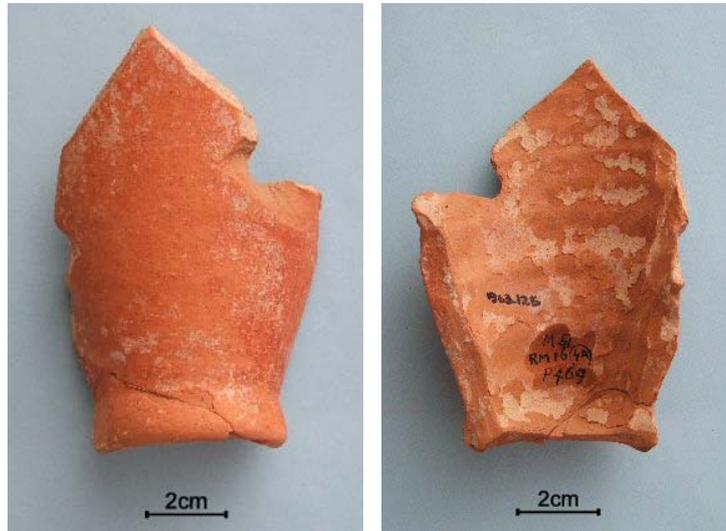


Figure 4.20: Sherd of a spindle bottle from the site of Myrtou-Pigadhes, Cyprus.

4.1.ii Turkey



Figure 4.21: Map of Turkey showing sources of sherd material (after Eriksson, 1993, fig.1 and Müller-Karpe, 2002, fig.2).

4.1.ii.a *Boğazköy*

Boğazköy in central Turkey is the site of the capital of the Hittite Empire, Hattuşa (fig. 4.21). Excavations began there in 1893-94, lead by Ernest Chantre. The first systematic excavation took place between 1906 and 1912, under the direction of Makridi, Winkler and Puchstein (Seeher, 1995). In 1931 Kurt Bittel took over the direction of the site and continued excavating from 1931 to 1963 with the exception of the years 1940-51 when digging ceased due to the Second World War and its aftermath (Seeher, 1995). Since then excavations have continued under the direction of Peter Neve (1963-1994) and Jürgen Seeher (1994 to the present) (Seeher, 1995). The primary publications are by Bittel, Neve and Seeher in *Archäologischer Anzeiger* and record the progress of the excavations year by year up to the present. A good summary in English is "Hattusha Guide: a day in the Hittite Capital" by Seeher (2002a).

The site was first occupied during the Chalcolithic period (6th millennium BC) but the first continuous habitation began towards the end of the Early Bronze Age when the Hatti people from north and central Anatolia settled there. It became an important city during the Middle Bronze Age, significant enough for a permanent Assyrian trading post to be established during the 19th and 18th centuries BC, and was established as the Hittite capital during the 17th century BC (Bryce, 2002, 230-232; Seeher, 2002a, 154-162). The city was destroyed by Kashkan tribes from north-central Anatolia during the reign of Tudhaliya III and the extensive rebuilding which followed destroyed most of the earlier city (Seeher, 2002a, 163ff). Apart from a few years during the reign of King Muwatalli II, Hattuşa remained the Hittite capital until the collapse of the Hittite

Empire although the last recorded Hittite king, Šupiluliuma II, probably moved his court away from Hattuša before the final destruction of the city c1180BC (Seeher, 2002a, 165-170).

As Hittite power began to wane, King Tudhaliya IV began a building programme in Boğazköy which resulted in a remodelled city of unprecedented size and splendour (Bryce, 2002, 232-234; Seeher, 2002a, 164-166). A new temple area was developed to the south of the old or Lower city which is now known as the Upper City bringing the total area of the enclosed city to about 180 hectares. This area contains the structural remains of about 30 temples (Bryce, 2002, 234-235; Seeher, 2002a, 64-68). RLWm ware is found in most areas of the city although it is difficult to get an accurate assessment of exactly how much and when it first appears in the archaeological record (Parzinger & Sanz, 1992; Mielke, 2007). Many examples seem to come from 14th and 13th century contexts (Eriksson, 1993, 129-131). However excavations by Seeher during 2000 and 2001 uncovered thousands of RLWm ware sherds in the fill of artificial ponds, known as the Southern Ponds (Seeher, 2001, 2002b). These ponds, originally built to supply the city with water, had partially silted up and then been filled in with much of the fill consisting of ceramic sherds (Seeher, 2001; 2002b; Knappett *et al.*, 2005). This unstratified material has been dated by ¹⁴C dating and ceramic typology to c.1400BC (Knappett, 2002; Seeher, 2002b; Knappett *et al.*, 2005; Mielke, 2007; Schubert & Kozal, 2007). The sherds for this study were selected by Knappett in 2001 from large sacks of material containing the sherd finds from the Southern Ponds (Knappett, pers. comm.) and are only identifiable by the numbers present on the sherds or the accompanying plastic

bags. These numbers were used to identify the sherds in this and previous studies. Seventeen sherds, 16 RLWm sherds and one local fabric, had been examined during a previous study (Steele, 2004, 56-64; Knappett *et al.*, 2005; Steele *et al.*, 2007) and one of the RLWm ware sherds (sherd 1) was re-extracted and the residue sent for GC-C-IRMS analysis during this study. A further 15 RLWm ware sherds and 9 local vessels of two distinct fabrics were examined for this study (table 4.1). Thin section analysis and NAA had previously been carried out on all these samples and they have been stored in plastic bags.

Of the 15 RLWm ware sherds six (sherds 15, 18, 20, 21, 26, 28 and 41) were positively identified as sherds from spindle bottles, sherd 11 was described as being from a small spindle bottle or arm-shaped vessel, sherds 22, 23 and 24 may possibly be from spindle bottles and sherds 12, 16, 25, and 29 were not identified. Sherd 41, if it is from a spindle bottle, is part of the base. It is very small and does not present an interior surface making it impossible to analyse for residues. All of the local sherds are classed as “closed shapes” (Knappett *et al.*, 2005). Analysis of the fabrics in thin section and by NAA reveals that sherds 11, 12, 15, 16, 18, 20, 21, 22 and 23 are all classic RLWm ware fabric. Thin section analysis shows sherds 24, 25, 26, 28, 29 and 41 are in a siltier, coarser fabric similar to a semi-coarse RLWm ware fabric found at other sites (p28). NAA shows this fabric to be very close in elemental composition to classic RLWm ware and these sherds are therefore considered to be a subgroup of the RLWm ware fabric (Knappett *et al.*, 2005). Of the local sherds, seven (32-35, 38 and 39) fall into one group labelled the ‘volcanic and

serpentinite' group when examined in thin section, while 36, 37 and 40 are all individually different. All are consistent with the local geology. When examined by NAA the local fabrics are very distinct from the RLWm ware samples and in many cases from each other (Knappett *et al.*, 2005).

All the RLWm ware sherds are in good condition with burnished exterior surfaces although some have been broken, probably before burial, and have limited areas of internal surface. The local sherds vary in appearance. All are coarser fabric than classic RLWm ware and several have a whitish slip on the exterior surface (fig. 4.22). However sherd 34 does have a red, burnished exterior surface (fig. 5.4) and 36 and 37 show a greyish interior surface. All sherds are from thick walled vessels.

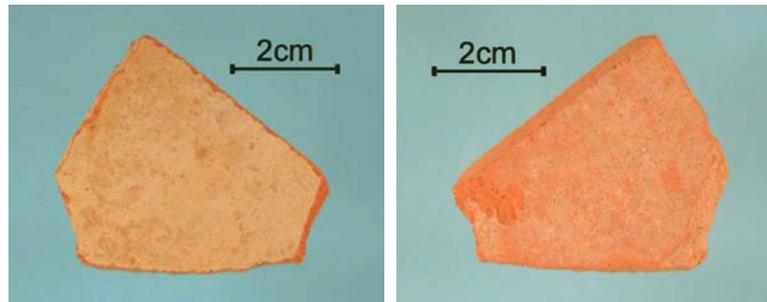


Figure 4.22: Sherd 34 from Boğazköy, Turkey. This sherd is not RLWm ware and shows a white slip on the exterior surface (left).

4.1.ii.b *Kilise Tepe*

The site of Kilise Tepe is situated in the valley of the Gösku River about 50km inland from the coast of southern Turkey (fig. 4.21). It was first identified by Mellaart during a survey of the valley carried out in the 1950s although Mellart reported it under the name of Maltepe (Postgate, 2007a). French also surveyed it during 1965 and published Late Bronze Age material from the site (Postgate, 2007a). During the 1980s the site was threatened by plans for a hydroelectric scheme which would have flooded the site and rescue excavations began there in 1994 and continued until 1998 (Postgate, 2007a).

The Gösku valley is one of the natural routes from the coast through the Taurus Mountains to the interior and Kilise Tepe occupies a commanding position on a promontory above the river close to its confluence with the River Kurtsuyu (Postgate, 2007b). This position, together with its location at the southern limit of direct Hittite government, made it an important centre during the LBA (Knappett, 2000; Postgate, 1998). Settlement began during the Early Bronze Age and continued more or less continuously through to the Byzantine era (Postgate, 2007c). Later occupation has made excavation of the LBA levels very difficult (Baker *et al.*, 1995; Postgate, 1998; Knappett, 2000). What remains of the LBA structures includes a series of relaid floors and several building phases (Postgate, 1998; Blakeney, 2007). The five levels are identified as a series of rooms, one of which was used a storeroom, and a courtyard (Blakeney, 2007). Only the stone foundations of the walls of these rooms survive and the space between them is occupied by filling material which in the earlier phases (IIIa-c) may be soil from demolition (Blakeney, 2007). Whether

these remains are domestic or had some ritual function is open to debate (Blakeney, 2007).

About 100 pieces of RLWm ware were found during the excavation of the site between 1994 and 1998 (Knappett *et al.*, 2005). During a previous study 11 sherds were sampled for residues, including a selection of the coarser types of RLWm ware that are found at this site (Steele, 2004, 65-71; Knappett *et al.*, 2005; Steele *et al.*, 2007). All of these sherds were selected by Carl Knappett and Nicholas Postgate from the site during the 1996-1998 seasons. Unfortunately it is impossible to determine exactly which sherds these are due to inconsistencies between the lists of sherds recorded in Knappett *et al.* (2005) and Knappett & Kilikoglou, (2007). It is clear that sherds numbered by Knappett 36, 37, 43, 201, 202, 203, 204, 205, 206, 208 and 5501 were the sherds analysed during the previous study (Steele, 2004, 65-71; Knappett *et al.*, 2005). The descriptions of these sherds and their contexts can be matched between the two records, but the numbers beginning S77 in Knappett & Kilikoglou (2007) and S79 in Knappett *et al.* (2005) cannot be reconciled and it is not clear how these numbers match any catalogue of finds in Postgate & Thomas (2007a). However the contexts in which these sherds were found are consistent.

The sherds excavated from level IIIId (the 4th LBA level) were from contexts 4211, 4205 and 1428 (Knappett *et al.*, 2005; Knappett & Kilikoglou, 2007). Contexts 4211 and 4205 were part of the fill in Room 34 located in squares H19-20 in the north western area of the site (Blakeney, 2007). This room had no floor but the floor level was deduced from a burnt patch of orangey clay

mixed with pebbles, probably a hearth, against wall 737 in the south east corner of the room. The walls of the room had been reduced to the foundations and the space between was filled with a brown, compacted material. The upper (4205) and lower (4211) levels of this fill provided much of the pottery typical of Level III (Blakeney, 2007). The area to the east of the building containing Room 34, in square I20, was probably open to the elements and was therefore known as the Eastern Courtyard. This was covered in destruction debris resulting from a fire fierce enough to partially melt some of the mud bricks in this layer. This debris (context 1428) was composed of mud brick masonry, fragments of bricks and loose ash and contained fragmentary pottery. At a later stage this debris was levelled off with packing material above and around it before the clean packing layer which formed the foundation of the Level IIIe courtyard was laid (Blakeney, 2007).

The sherds from Level IIa/b (the Bronze Age/Iron Age transition level), are from contexts 5501 and 5502 in square I19 (Postgate & Thomas, 2007b). These were part of the open area to the west of the Stele building known as the Western Courtyard from which the bulk of the level IIa/b ceramics came. When the foundations of the Stele building were laid this area was flattened, reducing the IIIId/e walls to their foundations. Above these walls in I19 was a layer of whitish material, then a fill into which some later wall foundations were cut (Postgate & Thomas, 2007b). Contexts 5501 and 5502 are part of a cut in this fill and the packing around it respectively (Postgate & Thomas, 2007b).

Originally these contexts were thought to be domestic (Baker *et al.*, 1995). However during the earlier phases of Level II there was a shrine on this part of the site and one of the most characteristic pottery shapes in Level III is the arm-shaped vessel which has been associated with a ritual function. This has led the excavators to suggest that the rooms in Level III may also have had a cultic function rather than being for domestic use (Postgate, 2007c).

All the sherds had been stored in plastic bags since the excavation and have been cut for thin section analysis and NAA (Knappett *et al.*, 2005). Eight of these sherds (36, 37, 43, 201, 202, 203, and 208) contained very small amounts of residue, mostly phthalates from plastic bags and small amounts of squalene, cholesterol and C_{16:0} fatty acid which represent residues from fingerprints acquired during handling (Steele, 2004, 66-67). One of the three remaining sherds (5501) yielded a residue from the interior surface containing C_{16:0} fatty acid with smaller amounts of C_{18:0}, C_{18:1} and C_{16:1}, together with a series of alkanes at low concentrations. This is probably modern contamination.

However the remaining two sherds, 205 and 206, contained a larger series of fatty acids on their interior surfaces. Sherd 206 produced C_{14:0}, C_{16:0}, C_{16:1}, C_{17:0}, C_{18:0}, C_{18:1}, and C_{20:0} fatty acids while sherd 205 produced a slightly smaller range of fatty acids in reduced quantities. In both sherds the residues contain more C_{18:1} than C_{18:0} and also a small peak tentatively identified as a plant sterol. Cholesterol, squalene and the inevitable phthalates were also present at low levels. Because of the interesting features of these two residues

these two sherds were re-sampled and the residues sent for GC-C-IRMS during this study (table 4.1). Sherd 205 is a semi-fine example of RLWm ware fabric from a jar with a thickened rim, while 206 is a semi-coarse to coarse sherd from an unidentified vessel. Sherd 206 has no burnished exterior surface (figs 4.23 and 4.24). Both these sherds came from context 4211.

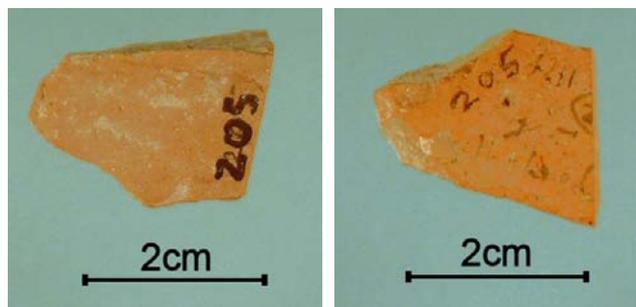


Figure 4.23: The exterior (left) and interior surfaces of sherd 205 from Kilise Tepe, Turkey.

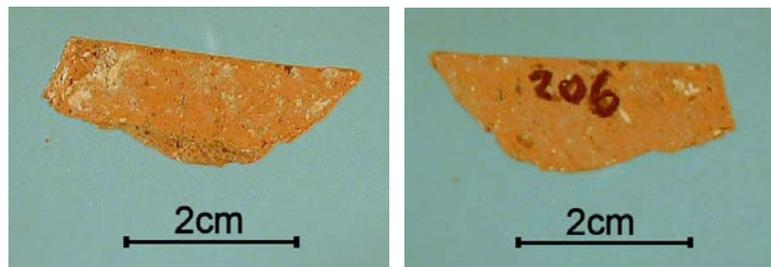


Figure 4.24: The exterior (left) and interior surfaces of sherd 206 from Kilise Tepe, Turkey. This sherd is in a coarse variant of the RLWm ware fabric and lacks any burnishing on the exterior surface.

4.1.ii.c *Kuşakli*

Kuşakli is 200km south east of Boğazköy, situated on a promontory on the edge of a deep valley at about 1600m above sea level (fig. 4.21). Clay tablets found at the site have identified the ancient name of the city as Sarissa, a significant centre during the LBA which was mentioned as a cult-centre of medium importance on tablets found at Boğazköy (Müller-Karpe, 2002). It also appeared among the nine towns mentioned in the Egyptian version of the Egyptian-Hittite peace treaty, signed after the battle of Kadesh and preserved on the outer wall of the temple to Amun at Karnak (Müller-Karpe, 2002). The site is a medium sized Hittite town of about 18 hectares in area, fortified with a wall, accessed by four gates. Occupation began in during the Old Hittite Kingdom (c. 1650/1600-1400/1350BC) and parts of the city were destroyed and rebuilt c.1400BC (Müller-Karpe, 2002). Hittite occupation ended with destruction contemporary with those at Boğazköy and other centres which mark the end of the Hittite Empire (c.1190BC) and during the Iron Age smaller settlements were built on the ruins (Müller-Karpe, 2002).

Four sherds were available for analysis and arrived in 2005 packed in paper envelopes (table 4.1). Three RLWm ware sherds came from the excavation on the West Slope, all three from the rubble of the third building layer (c.1525-1350BC) ((Müller-Karpe, 1997; Mielke, 2006, Plan 24). The buildings in this area appear to be domestic. The fourth sherd, not RLWm ware, came from a store room in Building C on the main acropolis which is assumed to have been the temple of the local weather god (c.1525-1350) (Müller-Karpe, 2002; Mielke, 2005, pers. comm.).

Sherds 1 and 2 are in a classic, very fine RLWm ware fabric (table 4.1). Sherd 1 has been cut from a larger sherd, an almost complete base of a spindle bottle with a circle inscribed at the centre almost identical to that on Hala Sultan Tekke sherd 7 (fig. 4.25) (Mielke, 2005, pers. comm.). Sherd 2 has been cut from a body sherd of a small spindle bottle with the stub of a handle still attached (Mielke, 2005, pers. comm.). Sherd 3 is a coarser fabric, still classified as RLWm ware, and was identified as possibly from the lower part of a spindle bottle. However, in the photograph of the original sherd supplied with the material, it appears that the wheel-throwing marks may curve (Mielke, 2005, pers. comm.). This could indicate that this is part of a pilgrim flask. All three sherds are very small ($\leq 4\text{cm}^2$).

The fourth sherd is not RLWm ware, but from a local brown polished spindle bottle made from fine clay (fig. 4.26) (Mielke, 2005, pers. comm.). Cornelia Schubert and Ekin Kozal examined other sections of the same sherds by NAA (Mielke, 2005, pers. comm.; Schubert & Kozal, 2007) and, although the presentation of their results is not entirely clear, they do show that the fabric of this vessel is significantly different in composition to RLWm ware (Schubert & Kozal, 2007).

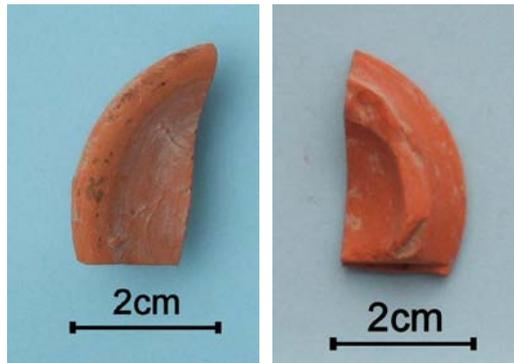


Figure 4.25: The exterior (left) and interior of sherd 1 from Kuşakli, Turkey.

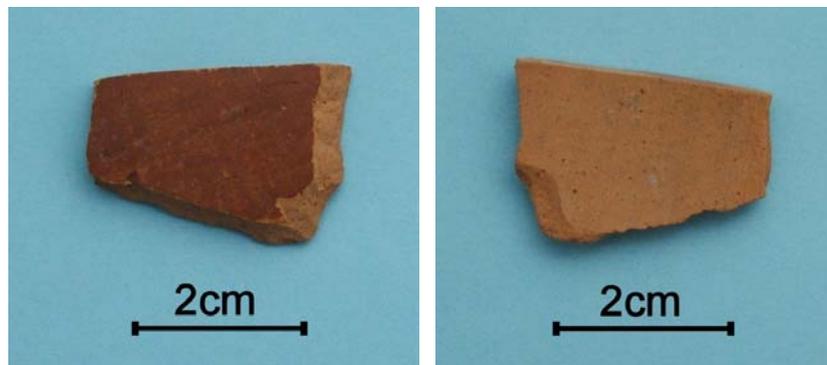


Figure 4.26: Sherd 4 from Kuşakli, Turkey. This sherd was part of a spindle bottle which was not RLWm ware. The exterior (left) has a brown polished surface.

4.1.iii Syria

The lack of samples from the area of Syria, Lebanon and Israel is of concern. This is one of the areas in which RLWm ware is found with some regularity and Syria was originally suggested as the source of the ware (see chapter 2, p8ff.). However, despite repeated efforts, material from this area only became available after the end of this study and remains to be investigated. The only site from which any material was available was Tell Tweini.

4.1.iii.a Tell Tweini

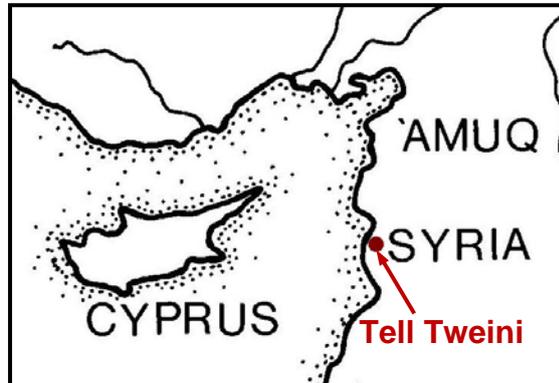


Figure 4.27: Map showing the location of the site of Tell Tweini, Syria.

The site of Tell Tweini (ancient Gibala) is 1km east of the centre of the modern city of Jableh on the Syrian coast (fig. 4.27). It is about 35km from the ancient centre of Ugarit. The project was initiated at the request of the Syrian Department of Antiquities and was carried out jointly by the Syrian Direction Générale des Antiquités et des Musées and the Belgian Katholieke Universiteit Leuven. Excavations between 1999 and 2007 were under the overall direction of Professors Al-Maqdissa and Van Lerberghe with Drs Badawi and Bretschneider serving as the field directors (Bretschneider & Van Lerberghe, 2008a).

The tell itself is a pear-shaped mound rising 15-20m above the surrounding fields at the junction of two streams, one of which reaches the sea 2km to the west (Bretschneider & Van Lerberghe, 2008a). The site was occupied from the 3rd millennium BC, although the surrounding plain has yielded remains of

Neolithic occupation from the 6th millennium BC (Bretschneider & Van Lerberghe, 2008b). The first documentary reference to Tell Tweini is on an Akkadian tablet from the archives of King Niqmepa of Ugarit (late 14th to early 13th centuries BC). These archives were established c.1350BC and finished with the destruction of Ugarit by the Sea Peoples c.1200BC. The reference is a treaty between King Niqmepa and a King Abdi'anati of Sianu, a city south of Ugarit and close to Gibala which appears in the list of cities belonging to Ugarit (Bretschneider *et al.* 2005; Bretschneider & Van Lerberghe, 2008b).

The very small (c.1cm²), featureless sherd (TWE-A-01056-C-002) analysed during this study was supplied directly by Dr Klaas Vansteenhuyse of Leuven University (table 4.1). He identifies it as the body fragment of a spindle bottle in RLWm ware from a LBA pit, probably LBI, dug through MBAII layers. Only seven RLWm ware fragments have been found at the site - six body sherds from spindle bottles, one a rim sherd. All were found in different contexts and it is assumed that they represent seven different vessels (Vansteenhuyse, 2008).

4.1.iv Egypt

Although no new residues from Egyptian contexts were analysed during this study one residue was re-extracted and sent for GC-C-IRMS. This was from the site of Saqqara.

4.1.iv.a Saqqara

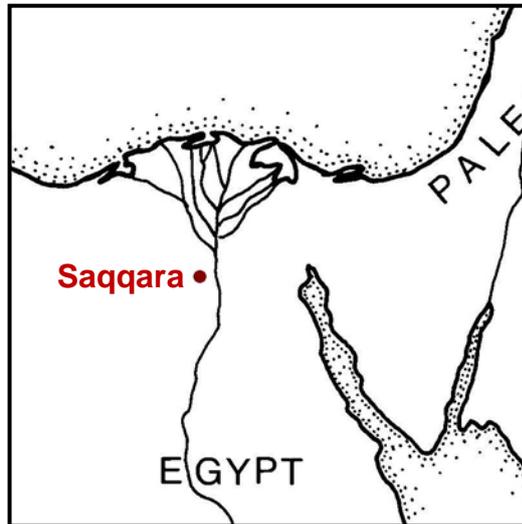


Figure 4.28: Location of the site of Saqqara, Egypt.

The site of Saqqara is about 30km south of Cairo on a limestone plateau between the River Nile and the Sahara Desert overlooking the remains of the New Kingdom administrative capital of Memphis (British Museum, 2001; University and the Rijksmuseum van Oudheden, 2004) (fig. 4.28). Saqqara was the local necropolis for Memphis and was used for burials for thousands of years (Bard, 2000; British Museum, 2001). The area closest to Memphis contains the oldest burials which are those of Early Dynastic Period nobles (c.3100-2686BC) (British Museum, 2001). There are 15 royal pyramids at Saqqara but the majority of burials are high priests and court officials, some of which are very elaborate and contain very rich grave goods (Bard, 2000; British Museum, 2001). During the 18th Dynasty (c.1550-1069 BC), contemporary with the import of RLWm ware into Egypt, many of the pharaohs' closest associates were buried at Saqqara – government officials, personal servants and army

commanders – together with high ranking priests (Bryan, 2000; van Dijk, 2000). The sherd re-analysed during this study was one of a collection of five sherds from surface burials, found lying on the ground close to the Sacred Animal Necropolis. They were not associated with any other objects but were found in an area that is covered in 18th Dynasty burials (Bourriau, 2004, pers. comm.; Eriksson, 2004, pers. comm.). Ms. Bourriau considers that they are early 18th Dynasty (mid 16th century BC) in date.

The sherd re-examined for this study (sherd 2) is classic, very fine RLWm ware and appears to be part of a spindle bottle (fig. 4.29). The interior surface has a flaky white appearance but is extremely hard. Examination with a hand lens (x10) revealed that any pores within the pottery had been filled with a brownish-grey material. Residue analysis revealed that the flaky white deposit on the interior surface contained no lipids but the body of the sherd yielded a very high quantity of lipid, over 1700 µg/g. This consisted of saturated fatty acids (C_{16:0}, C_{18:0}), short-chain saturated fatty acids (C_{8:0}, C_{9:0}, C_{10:0}), unsaturated C_{18:1}, two dicarboxylic fatty acids (C_{8:0}, C_{9:0}) and several peaks which further analysis identified as hydroxy fatty acids (Steele, 2004, 80-81; Knappett *et al.*, 2005; Steele *et al.*, 2007). The presence of plentiful hydroxy fatty acids combined with dicarboxylic acids probably indicates a polymerised and degraded plant oil (Mills & White, 1999, 35-40, Regert *et al.*, 1998; Copley *et al.*, 2005d). GC-C-IRMS was carried out on this residue to determine whether it was a plant oil or an animal fat.

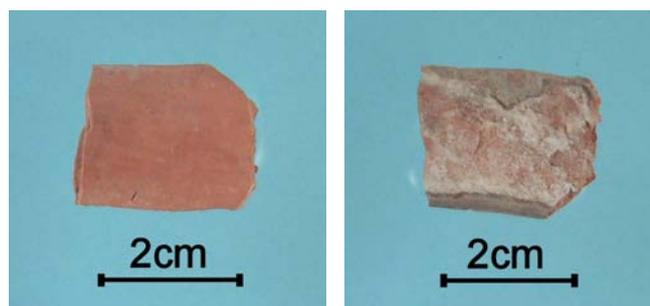


Figure 4.29: The exterior (left) and interior of sherd 2 from the site of Saqqara, Egypt.

4.2 Visible residues

Three of these were available for study – two recently obtained from museum material and one examined during an earlier study.

4.2.i Cyprus

The visible residue originating in Cyprus is from a spindle bottle now housed in the Medelhavsmuseet in Stockholm (catalogue no. MM SHM 607:172). It was originally in several pieces and contained what ~~Pa~~Åström describes as “a black resinous substance” (Åström, 1969). At some time, at least before 1969, the bottle was reconstructed but a portion of the black residue was kept separately in a plastic container (Slej, 2007, pers. comm.). There is no information about the provenance of this vessel except that it is probably from Cyprus (Åström, 1969). The residue was examined by several analysts who independently suggested that it might be asphalt or bitumen, honey or a

reducing sugar from fruit (Åström, 1969). There are no details of the first of these analyses but the second two were conducted using wet chemistry (Åström, 1969). The residue is now a fairly hard, brown, mass with a slightly granular appearance which fragments easily. A generous amount was transferred to a cleaned glass scintillation vial by staff at the museum using a cleaned disposable scalpel and shipped to Bradford by post for analysis.

4.2.ii Egypt

4.2.ii.a Royal Ontario Museum sample

The first residue from Egypt is from a spindle bottle in the Egyptian Department of the Royal Ontario Museum in Toronto, Canada (catalogue no. 910.85.15(B.969)) (Eriksson, 1993, 216; McGovern, 1997). No details of provenance are available for this spindle bottle except that it came from Egypt. The bottle is still sealed but some of the contents had leaked out and dried on the exterior surface (McGovern, 1997). This dark brown deposit was examined by Patrick McGovern using diffuse-reflectance Fourier-transform Infra-red spectrometry (FT-IR) and high performance liquid chromatography (HPLC) (McGovern, 1997).

The IR spectrum which is reproduced in McGovern's publication (McGovern, 1997, fig. 3) shows strong peaks between 1700 and 1800 cm^{-1} , a double peak with maxima at about 2850 cm^{-1} and just above 2900 cm^{-1} and two broad clusters of peaks, one between 1150 and 1500 cm^{-1} and the other between 3100 and 3550 cm^{-1} . There are also some peaks between 400 and 800 cm^{-1} . McGovern

identifies this as a mixture of terebinth resin and tartaric acid (McGovern, 1997). He particularly identifies maxima at $1750\text{-}1725\text{ cm}^{-1}$, $1450\text{-}1460\text{ cm}^{-1}$ and $1240\text{-}1225\text{ cm}^{-1}$ as being, “definitive for the carbonyl and carboxylic acid groups of tartaric acid”. The spectrum for the RLWm ware sample however is not very clear between 1200 and 1400 cm^{-1} with these peaks being imposed on a broader maximum. Unfortunately the maxima between 2850 and 2900 cm^{-1} are characteristic of many carboxylic acids and is observed for fatty acids such as palmitic and stearic acid as well as tartaric acid (Pouchert & Chemical Company, 1985, 485, 523) and in general broad peaks between 2500 and 3300 cm^{-1} are characteristic of O – H bond stretching in fatty acids (Open University Course Teams, 1978, 69). Tartaric acid also produces two strong maxima between 3300 and 3400 cm^{-1} which are only visible as very weak peaks in this instance (Pouchert & Aldrich Chemical Company, 1985, 523). The maximum at about 1700 cm^{-1} is also commonly observed in the spectra of other fatty acids (Pouchert & Aldrich Chemical Company, 1985, 485, 523) and is produced by a stretching in the C = O bond in carboxylic acids (Open University Course Teams, 1978, 70).

The identification of terebinth resin was made by comparing the spectra of commercial myrrh and terebinth resin from the Ulu Burun shipwreck with those of the test materials. Unfortunately the strongest maxima in the myrrh and terebinth spectra are $2800\text{-}3000\text{ cm}^{-1}$ and $1725\text{-}1750\text{ cm}^{-1}$, both of which are common to carboxylic acids. Identification then relies on using strong peaks at 1460 , 1380 and 1250 cm^{-1} . In the RLWm ware sample these have merged into one broad peak with small maxima superimposed, none of which match with the

maxima in either resin spectrum. Interestingly there are generally multiple maxima in this area of the spectrum of various isomers of tartaric acid, although not in fatty acids (Pouchert & Aldrich Chemical Company, 1985, 485, 523).

The HPLC results were also rather undiagnostic, producing three peaks in the chromatogram which do not entirely match those of either the tartaric acid or resin standards (McGovern, 1997, fig.9). As no mass spectrometry was carried out on these compounds, a definite identification was not possible and UV spectra of the peak at 1.6 min appear inconclusive (McGovern, 1997, fig.11). After examining McGovern's results in detail it appears that none of the conclusions drawn about the nature of this residue are supported by the evidence presented.

A small amount of this residue was transferred to a clean glass scintillation vial by museum staff using a clean disposable scalpel and shipped to Bradford by post for analysis.

4.2.ii.b Saqqara residue

The residue from Saqqara (fig. 4.30) was examined by gas chromatography-mass spectrometry (GC-MS) during a previous study. It is a layer of brown residue, approximately 1.0cm in thickness, adhering to the interior surface of sherd 1 from the collection described above (p89-91). The residue is rubbery in texture and sticky in consistency and examination with a hand lens (x10) reveals that it is not uniform but varies in colour. The residue dissolved completely in the solvents used (DCM:methanol (2:1v/v)) and GC-MS analysis

showed C_{16:0} fatty acid was the largest constituent. Two hydroxy fatty acids were also present in significant quantities as well as small amounts of C_{18:0} and azeleic acid. Saponification of the residue released a series of saturated fatty acids ranging from C_{9:0} to C_{24:0}. This combination of fatty acids suggests the starting material might have been a plant oil, rich in unsaturated fatty acids, which had polymerised. Bulk stable isotope analysis revealed a mean $\delta^{13}\text{C}$ value of $-26.22\text{‰} \pm 0.3\text{‰}$. This is within the range for C₃ plants (approximately -23‰ to -30‰) but also within the range for ruminant animal fats (approximately -23.5‰ to -33‰) (Steele, 2004, 75-79; Knappett *et al.*, 2005; Steele *et al.*, 2007). These results were not very conclusive and the residue was re-examined several times by GC-C-IRMS in an attempt to identify the original material in this residue.

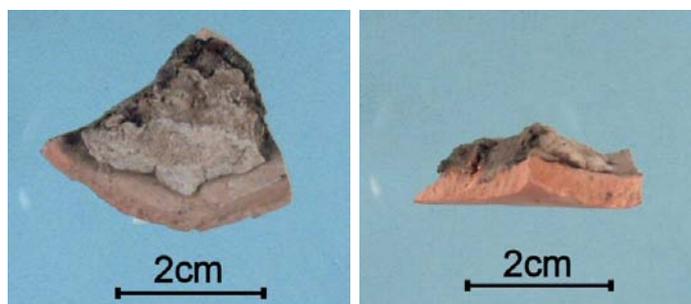


Figure 4.20: Sherd 1 from Saqqara, Egypt, with the visible residue adhering to the interior surface.

All the residues, both visible and absorbed were analysed using a variety of techniques, principally gas-chromatography both alone and with mass spectrometry. These are described in detail in the following chapter.

Table 4.1: Complete record of all sherd samples analysed.

Site	Museum	Museum Inventory number	Site catalogue number/context information	Number assigned for this study	Shape of vessel
Arpera, Cyprus	Ashmolean Museum, Oxford	1953.1159a	Surface find ¹	AR1	Spindle bottle base
		1953.1159t	Surface find ¹	AR2	Spindle bottle base
		1953.1159c	Surface find ¹	AR3	Spindle bottle base
		1953.1159d	Surface find ¹	AR4	Larger base
		1953.1161b	Surface find ¹	AR5	Spindle bottle body
		1953.1162b	Surface find ¹	AR6	Pilgrim flask body
		1953.1162c	Surface find ¹	AR7	Pilgrim flask body
		1953.1162d	Surface find ¹	AR8	Spindle bottle/arm body
		1953.1162e	Surface find ¹	AR9	Spindle bottle/arm body
		1953.1162k	Surface find ¹	AR10	Spindle bottle/arm body
Dhenia, Cyprus	Ashmolean Museum, Oxford	1953.870	Looted tomb material ^{2,3}	D1	Neck, handle and part of upper body of pilgrim flask
Enkomi, Cyprus	Ashmolean Museum, Oxford	1953.11562m	Unknown ¹	E1	Spindle bottle, body/neck
		1953.1162n	Unknown ¹	E2	Undetermined body sherd
Hala Sultan Tekke, Cyprus	N/A	N/A	LBA well, deposit F1 ^{4,5}	HST1	Undetermined body sherd
			LBA well, deposit F1 ^{4,5}	HST2	Undetermined body sherd
			LBA well, deposit F1 ^{4,5}	HST3	Bowl/juglet
			LBA well, deposit F1 ^{4,5}	HST4	Spindle bottle/arm body
			LBA well, deposit F1 ^{4,5}	HST5	Pilgrim flask body
			LBA well, deposit F2 ^{4,5}	HST6	Juglet/closed vessel
	Ashmolean Museum, Oxford	1953.1159f (?)	Surface find (Frankel & Catling 77) ^{6,7}	HST7	Spindle bottle body
		1953.1161e	Surface find (Frankel & Catling 80) ^{6,7}	HST8	Spindle bottle body
		1953.1162g	Surface find (Frankel & Catling 82) ^{6,7}	HST9	Pilgrim flask body
		1953.1162h	Surface find (Frankel & Catling 83) ^{6,7}	HST10	Spindle bottle body
		1953.1162i	Surface find (Frankel & Catling 84) ^{6,7}	HST11	Spindle bottle body
		1953.1162j	Surface find (Frankel & Catling 85) ^{6,7}	HST12	Spindle bottle body
		1953.1162l	Surface find (Frankel & Catling 87) ^{6,7}	HST13	Pilgrim flask body

Table 4.1 continued.

Site	Museum	Museum Inventory Number	Site catalogue number/context information	Number assigned for this project	Shape of vessel
Kalavastos, Cyprus	Larnaca Museum, Cyprus	Unknown	M50B, 24.2 – tomb material looted in LBA ^{5,8}	KAL1	Pilgrim flask body
		Unknown	M50B, 24.2 – tomb material looted in LBA ^{5,8}	KAL2	Pilgrim flask body
		Unknown	M50B, 20.2 – tomb material looted in LBA ^{5,8}	KAL3	Pilgrim flask body
		Unknown	Tomb 13, 5.1 ^{5,8}	KAL4	Spindle bottle shoulder
		Unknown	Tomb 14, 6.3 ^{5,8}	KAL5	Pilgrim flask body
		Unknown	Tomb 14, 6.3 ^{5,8}	KAL6	Pilgrim flask body
		Unknown	Tomb 14, 5.9 ^{5,8}	KAL7	Spindle bottle body
		Unknown	Tomb16, 4.1 ^{5,8}	KAL8	Spindle bottle body
		Unknown	Tomb 11 ^{5,8}	KAL9	Not RLWm ware
		Unknown	Tomb 11 ^{5,8}	KAL10	Spindle bottle body
Kazaphani, Cyprus	Cyprus Museum, Nicosia	Unknown	Tomb 2b, Cat no. 548 ^{5,9}	K4	Bowl?
		Unknown		K5	Bottle, flask, jug, bowl?
		Unknown		K6	Closed shape body
		Unknown		K7	Bowl?
		Unknown		K10	Not RLWm ware
Kouklia, Cyprus	N/A	N/A	M.PIT.5.1 ^{5,10}	KOU1#	Arm body
			KA 464.13A ^{5,10}	KOU2	Too small to sample
			KA 508.12A ^{5,10}	KOU3	Spindle bottle body
			TE III 138 ^{5,10}	KOU5	Spindle bottle body
			KA 637.4 ^{5,10}	KOU6#	Spindle bottle body?
Myrtou-Pigadhes, Cyprus	Ashmolean Museum, Oxford	1963.125	Form 131/P469 ¹¹	MP1	Spindle bottle body

Table 4.1 continued

Site	Museum	Museum Inventory Number	Site catalogue number/context information	Number assigned for this project	Shape of vessel
Boğazköy, Turkey	N/A	N/A	Fill of artificial ponds in upper city ^{5, 12}	B1#	Large spindle bottle body
				B11	Small spindle bottle/arm body
				B12	Large vessel
				B15	Spindle bottle body
				B16	Undetermined
				B18	Spindle bottle body
				B20	Spindle bottle body
				B21	Large spindle bottle body
				B22	Spindle bottle body?
				B23	Spindle bottle body?
				B24	Spindle bottle body?
				B25	Undetermined
				B26	Spindle bottle body
				B28	Undetermined
				B29	Undetermined
				B32	Not RLWm, closed shape
				B33	Not RLWm, closed shape
				B34	Not RLWm, closed shape
				B35	Not RLWm, closed shape
				B36	Not RLWm, closed shape
				B37	Not RLWm, closed shape
B38	Not RLWm, closed shape				
B39	Not RLWm, closed shape				
B40	Not RLWm, closed shape				
B41	Too small to sample				

Table 4.1 continued

Site	Museum	Museum Inventory Number	Site catalogue number/context information	Number assigned for this project	Shape of vessel
Kilise Tepe, Turkey	N/A	N/A	Knappett no. 205, context 4211 ^{5, 13}	KT205#	Jar
			Knappett no. 206, context 4211 ^{5, 13}	KT206#	Undetermined
Kuşakli, Turkey	N/A	N/A	95/657; 77.15; building rubble ¹⁴	KU1	Spindle bottle base
			97/629; 11.49; building rubble ¹⁴	KU2	Spindle bottle body
			97/619; 11.47; building rubble ¹⁴	KU3	Pilgrim flask/spindle bottle body
			KU 03/47; storage room, building 3, probably temple ¹⁵	KU4	Not RLWm ware, spindle bottle body
Tell Tweini, Syria	N/A	N/A	TWE-A-01056-C-002; LBA pit ¹⁶	TT1	Undetermined
Saqqara, Egypt	N/A	N/A	Surface find ¹⁷	SAQ2#	Spindle bottle

Key to references: ¹ Sherratt, pers. comm.; ² Frankel & Webb (2007); ³ Åström & Wright (1962); ⁴ Öbrink (1983); ⁵ Knappett *et al.* (2005); ⁶ Frankel & Catling (1976); ⁷ Åström *et al.* (1976); ⁸ South & Steel (2007); ⁹ Nicolaou & Nicolaou (1989); ¹⁰ Maier & Karageorghis (1984); ¹¹ Taylor (1957); ¹² Seeher (2002b); ¹³ (Blakeney, 2007);