Provenancing of a Group of Roman Lamp Potsherds from Abila (Qweilbeh), North Jordan

Lamia El-Khouri & Ahmed Al-Shorman

Abstract: *The provenance of a collection of Roman pottery lamps (17 sherds) from Abila (Qweilbeh), north Jordan, was investigated using typology, mineralogy, microtexture, and geochemical analyses using petrography, XRD, XRF, and AAS techniques, respectively. The studied sherds were classified into five groups according to the common archaeological typology, visible fabric, shape and clay color. The chemical analyses showed that these groups could be divided into two: the locally made using calcareous ferruginous clay (16 sherds), and the imported (one sherd).*

Keywords: Roman pottery lamps; Abila; Roman Jordan; pottery provenance; pottery typology; archaeometry.

Introduction

Local pottery production in the Roman sites of the northern region of Jordan has remained to be fully investigated. Most if not all Roman sites showed a continuous intensive occupation, especially during the preceding Byzantine period. This fact had its influences on the modes and activities of daily life in which pottery production was prominent. This study, therefore, investigated a collection of Roman pottery lamps, dated to the 1st-3rd centuries AD, found in a Roman tomb at Abila (Qweilbeh) in northern Jordan (Fig. 1). Rather than being limited to any particular region, the typology of these lamps is common to most Roman sites in Palestine and Jordan (Hadad 2002: 148). The visual inspection showed varied paste color, texture, and hand-made incisions, which led to the main assumption of the research regarding the provenance of these cultural materials. Since the lamps typology is a sign of local pottery production, careful investigations may determine the provenance, especially at the site of Abila or its surrounding region. Therefore, the primary classification of color and fabric separated these lamps into five different groups (see below) of different localities. Based on these preliminary observations, this study aims to identify the provenance of oil lamps and explore the local pottery production in the region.

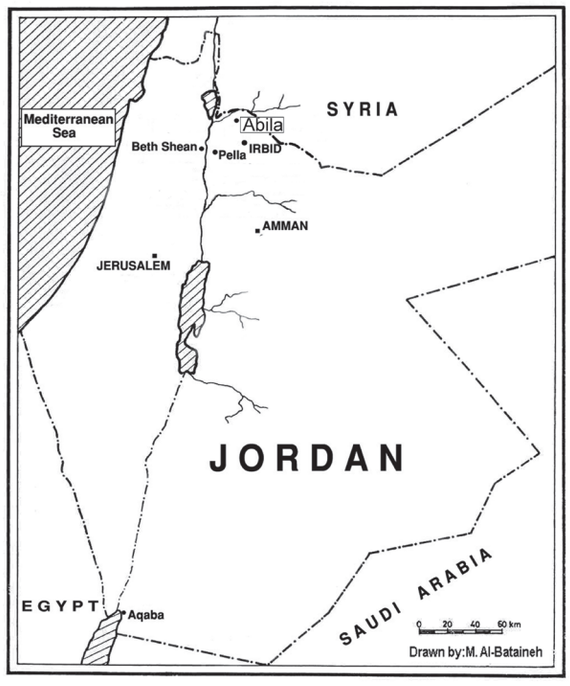

Fig. 1: Location of Abila in Jordan

ISSN: 1319-8947 (pp. 19-32)

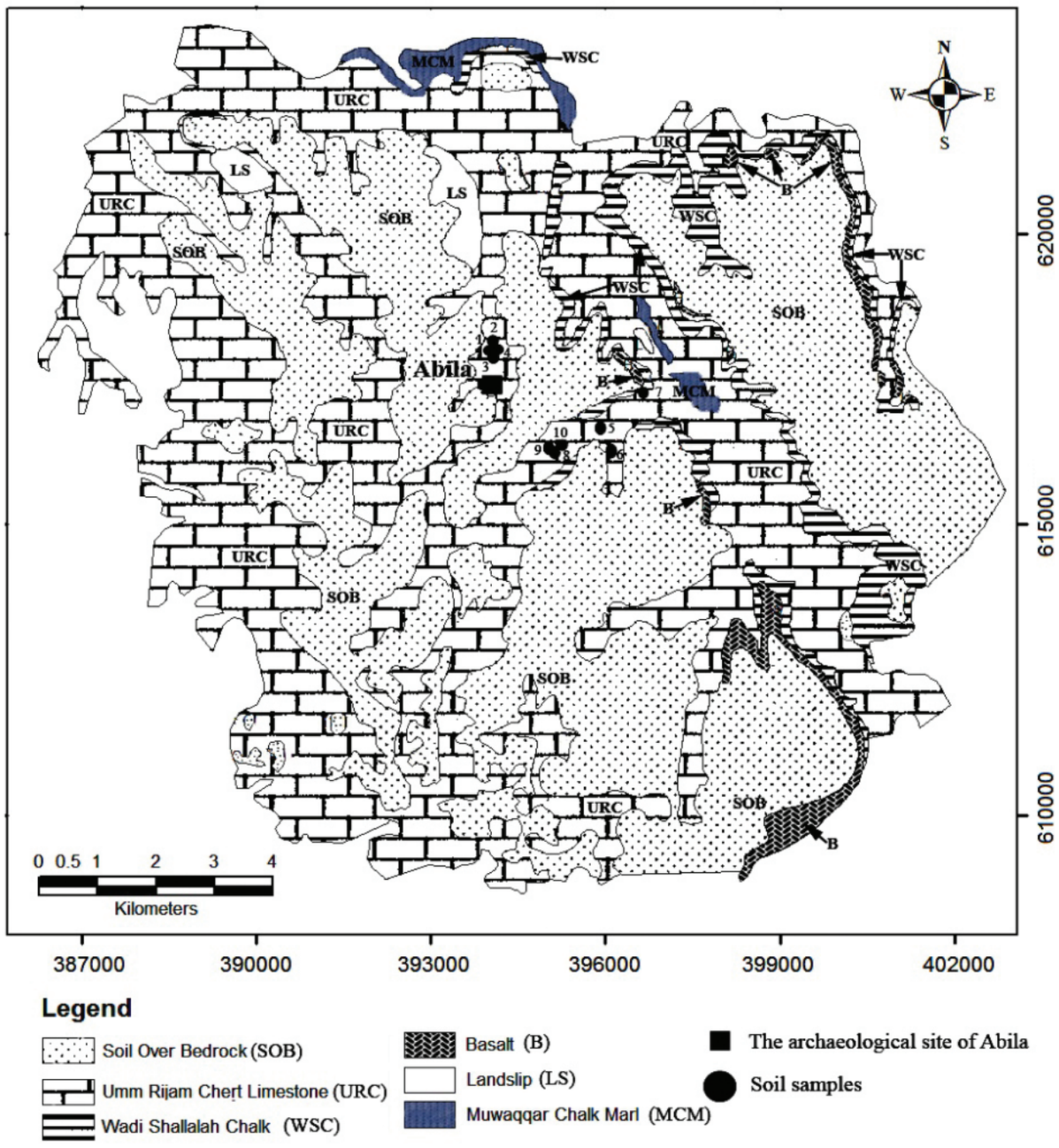

Fig. 2: A geological map of Abila, its surrounding area and soil samples locations (modified after Moh'd 1997).

Materials and methods

This study comprised the analysis of 17 oil lamp sherds discovered at a tomb at the site of Abila in northern Jordan. An integrated approach, i.e. geochemical and mineralogical, was used for provenancing and characterizing the samples, after Mommsen (2004), as follows: the samples were investigated using macroscopy and typology; then 10 of the 17 oil lamps sherds were selected and subjected to mineralogical

investigation using polarized light microscope, and XRD (Shimadzu XRD-600). After that, pressed powdered of the same 10 samples, using cellulose as binder, were prepared and analyzed for identifying their chemical composition using ED-XRF (MiniPal2, PW 4030/45). For comparison purposes, another 10 soil samples were collected from Abila and the surrounding area (Fig. 2). The samples were sieved using a 2 mm size sieve, ground and analyzed for their chemical composition using ED-XRF as well.

Description and typology of oil lamp sherds

The assemblage consists of 17 lamp sherds in a fragmentary state; they are mold-made, of rounded closed-shape body type, with a small rounded nozzle, a decorated discus, a small filling hole, and a low disc base or a ring base usually defined by a groove. Most of the lamps have no handles except for two of them (Qw 4.3 and Qw 5.1), which have small projected handles at the rear, and slightly rose upwards.

Most discuses are concave with an oval border, decorated either with projected mythological scenes or with small lines. Some lamp sherds show stamped leaves, darts, and circle decorations, and triangle decorations on the lamp shoulders (double axes occasionally decorated some shoulders); in some lamps, volute decoration adorns the nozzles. The lamps seem to have been made by using a worn mold and; after molding, a sharp instrument was used to incise over the main worn shapes and scenes that decorate the discus and the shoulders of the lamps (e.g.: Qw 3.3).

The five groups noted previously are typical Roman lamps, which are identified based on parallel examples from neighboring sites that are dated to the 1st – 3rd centuries AD (Hadad 2002: 147). In Bet Shean, for example, this type of lamps was used extensively during the early Roman period, continued to be used during the Late Roman period, and was of local and imported provenance. Both groups are similar in shape but different in terms of wall thickness, and clay and slip colour (Hadad 2002: 16). The imported ones seem to be made of better levigated clay with minimal visible grits.

In our assemblage most lamps are made of buff, pink, or light red poorly levigated clay. Only one lamp (Qw 5.1) was made of coarse yellowish clay. The clay includes visible small black and white grits. Few of them were slipped with a red or dark brown slip.

The lamps were classified into five groups according to the fabric, color and visible characters. As discussed below, three samples represent group 1, five samples represent group 2, five samples represent group 3, three samples represent group 4, and 1 sample represents group 5.

Group 1

This group consists of 3 lamp sherds (Qw 1.1, Qw 1.2, and Qw 1.3). The group is characterized by a fine texture and light red (2.5YR 6/6) to pink (5YR 7/4) paste (Fig. 3), with fine white, brown and infrequently gray inclusions. A burnished surface with traces of red slip on the outer surface was preserved on lamp sherd Qw 1.2.

Qw 1.1: Round body with a small round nozzle, a decorated discus, a small filling hole, a low disc base, no handles, radial decorations on the discus surrounding the filling hole, and stamped triangles of rounded edges pressed roughly on the shoulder.

Qw 1.2: Round body with a red slipped coarse surface. The discus is decorated with a stunning depiction of Helios surrounded by radials, while the shoulders are decorated with stamped

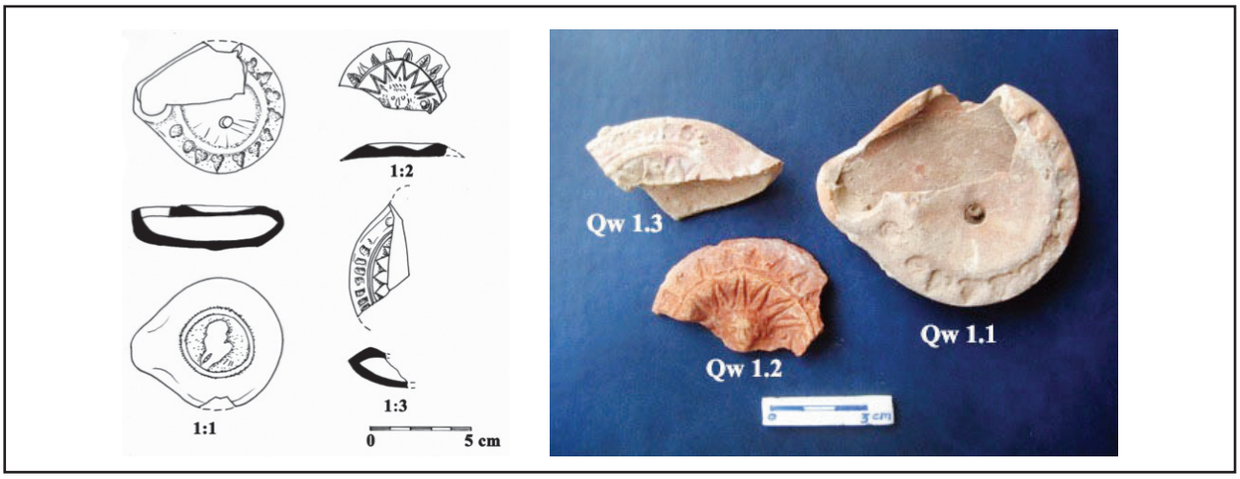

Fig. 3: Lamp sherds of group 1

leaves as a typical shape of the 2nd-3rd centuries Roman lamps.

Qw 1.3: Round body with traces of red slip on the outer surface, and worn stamped circles on the shoulder, depicting perhaps a Helios on the discus, only radials are visible.

Group 2

This group is represented by 5 lamp sherds (Qw 2.1- Qw 5). The discuses are decorated with mythological scenes or small radial lines. The paste is fine pinkish (5YR 7/3) with very fine gray and brown grits (Fig. 4). Red slip appears on one lamp sherd (Qw 2.1).

Qw 2.1: Round body with a small round nozzle adorned with volute shapes, decorated shoulder with circular shapes and double axes and red slip on the outer surface.

Qw 2.2: Round body with volute decorations adorns the nozzle. The discus is decorated with small radials, a small filling hole in the discus. The shoulders are decorated with impressed triangular shapes having rounded edges.

Qw 2.3: Round body has plain shoulders. The discus is decorated with probable Cupid or Eros scenes.

Qw 2.4: Round body with triangular and rounded roughly-impressed decorations on the shoulder. Discus is missing; only a small part is still preserved showing that it was originally decorated.

Qw 2.5: Round body with triangular roughly-impressed decorations on the shoulder. The discus is decorated with a mythological bust, perhaps of Jupiter, and radiating lines.

Group 3

Five lamps are assigned to this group, made of light red (2.5YR 6/6) paste, with very fine but few gray, white and brown grits. Red slip is visible on lamp sherds Qw 3.1 and Qw 3.2 (Fig. 5)

Qw 3.1: Round body with traces of double axes on the shoulder and a concave discus decorated with leaves.

Qw 3.2: Round body with shoulder decorated with irregular impressions. Volute decorations adorn the nozzle, concave discus decorated with a Medusa head and a small filling hole.

Qw 3.3: A concave discus decorated with a lion, perhaps an execution in the circus (damnation and bestirs). The lion shape was incised after being molded in a worn mold.

Qw 3.4: A concave discus and part of a shoulder. The shoulder is decorated with irregular shapes mostly circles; the discus is decorated with a running deer.

Qw 3.5: Round body with very thick walls, and a slightly concave discus featuring probably the god Eros (Cupid) with opened wings.

Group 4

This group is presented by 3 lamp sherds, made of white (10YR 8/2) to light gray (10YR 7/2) paste, with fine black and white inclusions (Fig. 6). There are traces of dark brown slip on the surfaces of lamp sherds Qw 4.1 and Qw 4.3. Only 1 lamp sherd has a handle (Qw 4.3). Based on the slip color and wall thickness, this group of lamp sherds was probably imported.

Qw 4.1: Round body with a small nozzle adorned by volutes, and a small filling hole. The shoulder is decorated with circular shapes. Dark brown slip on the outer surface and well levigated

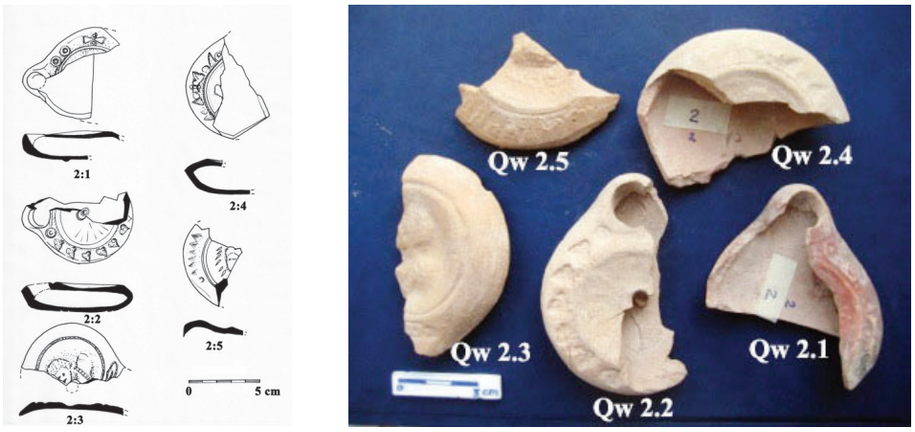

Fig. 4: Lamp sherds of group 2

Fig. 5: Lamp sherds of group 3

thin walls.

Qw 4.2: Round body with a concave discus, decorated with radiating lines, has a small filling hole in the center, volutes adorn the nozzle, and stamped decorations on the shoulder.

Qw 4.3: Round body with a high projected handle. The shoulder is decorated with what appeared to be vine grapes; and there is a brown slip on the outer surface.

Group 5

Only 1 lamp sherd is assigned to this group. It is differentiated by the ware colour and the clay texture that is coarser than that of the other lamp sherds (Fig. 7).

Qw 5.1: Round body with a high projected handle, made of very coarse pale yellow paste (2.5Y 8/4), concave undecorated discus with a small filling hole is in the center.

This type of lamp potsherds is very common in the region and elsewhere in other Roman provenances1. It was found in large quantities, albeit mostly fragmentary at Beth Shan (Hadad 2002, Table 1: 152), appeared in northern and southern Palestine (Hadad 2002, Table 2: 152), and at Palmera (Hadad 2002, Table 4: 154). Similar examples were found at Abila (Fuller 1993: 476-483), Bet Shean (Type 7, a provincial variations, have thicker walls than similar imported variants) (Hadad 2002: 16-18, nos. 19-29), Pella (McNicoll et al. 1992: 132, 140, Pl. 87:2-3, Pl. 93:10-11, Pl. 94:j-k), Dor (Types 26 and 27) (Rosenthal-Heginbottom 1995: 244-246), Beth She'arim (Avigad 1976: 185, Pl. LXX:5-6), Apollonia-Arsuf (Wexler and Gilboa 1996), Silet edh-Dhahr (Type II) (Sellers and Baramki 1953: 32-34), and Corinth (Type XXV) (Broneer 1930: 83-87).

Microtexture and mineralogy of the oil lamp sherds

Petrographical investigation of the samples revealed that they could be classified into three fabric classes:

Class 1

This class consists of 4 samples (Qw 1.1, Qw 2.2, Qw 3.1, and Qw 3.3). It is characterized by fine fabric, which contains ca. 15 % fine, subangular to rounded non-plastic inclusions, and optically active to slightly inactive homogeneous groundmass (Fig. 8a). The fabric colors are light brown to yellowish brown in the plane polarized light (PPL) and light reddish brown to brown in cross polarized light (CPL).

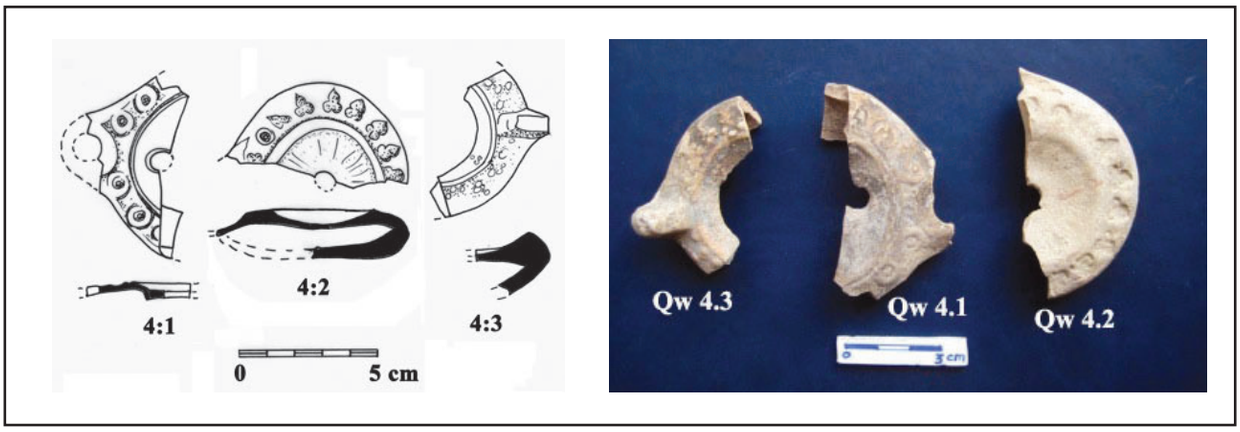

Fig. 6: Lamp sherds of group 4.

Fig. 7: Lamp sherd of group 5.

Inclusions are well sorted with unimodal grain size distribution; they consist mainly of quartz (ca. 10 %) and micrite calcite (ca. 5%).

Class 2

Samples Qw 1.2, Qw 4.1, Qw 4.2, and Qw 5.1 belong to this class. The fabric is fine and the groundmass is homogeneous and slightly optically inactive (Fig. 8b). The color is light yellowish gray in PPL, and light brownish gray in CPL. The amount of non-plastic inclusions is higher than class 1 (15 – 20 %); they are characterized by fine, subangular to subrounded, well sorted with unimodal grain size distribution, and consist of quartz (10 – 15 %), and micrite calcite (ca. 5 %). This class is characterized by the presence of a relatively high amount of well developed golden brown rhombic dolomite crystals in the matrix stained with iron oxide (Fig. 8c)

Class 3

Two samples belong to this class: Qw 2.1 and Qw 3.2. The fabric is medium. The groundmass is inhomogeneous and optically active to slightly inactive (Fig. 8d). It is characterized by yellowish to reddish brown colors in PPL, and light brown to brown in CPL. This group contains the highest amount of non-plastic inclusions (25 – 30 %). They are fine to medium, subangular to subrounded, badly sorted with bimodal grain size distribution. Quartz grains (10 %) are fine and subangular, while micrite calcite (10 %) fragments are fine to medium and subrounded. In addition, sample Qw 2.1 contains (ca. 5%), medium to coarse and subangular grog fragments (Fig. 8e). Sample Qw 3.2 contains (ca. 7%) medium subrounded basalt fragments (Fig. 8f).

Most of the non-plastic inclusions in the three groups are available in the lithology of Abila and its surroundings (Moh'd 2000) (Fig. 2). In class 3, the bimodal (hiatal structure) grain size distribution in pottery usually indicates that the coarse grains are deliberately added (Maggetti 1982). However, in sample Qw 2.1 grog was added by the potter, while the low amount and the rounded grain shape of the other inclusions, such as basalt in sample Qw 3.2 and micrite calcite in both samples, are naturally existent in the clay used for their manufacture. However, XRD results confirmed this categorization; almost all samples contain quartz and calcite as major constituents, plagioclase as a minor and hematite as a trace (Fig. 9a, b and c). In addition,

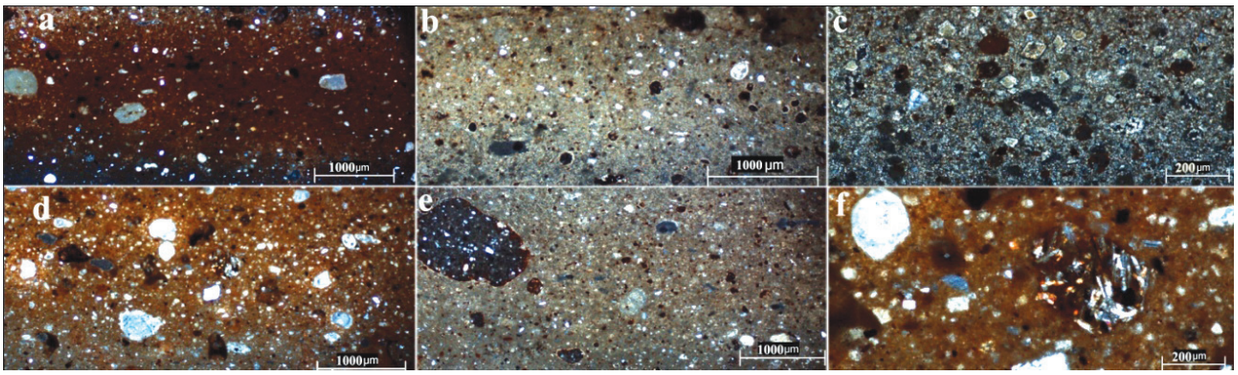

Fig. 8: Micrographs showing the fabrics of different classes, all taken in CPL. a: Qw 1.1, class 1, b: Qw 4.1, class 2, c: Qw 1.2, class 2, dolomite rhombs, d: Qw 3.2, class 3, e: Qw 2.1, class 3, grog fragment (upper left), f: Qw 3.2, class 3, basalt fragment (middle right).

XRD revealed some important differences in the mineralogical composition among the three classes. The first class contained gehlenite (except for Qw 3.1) as minor phase, and apatite (samples Qw 2.2 and Qw 3.3), dolomite (Qw 1.1), and illite (Qw 3.1) as trace phases (Fig. 9a).

Apatite was incorporated in the clay as a result of leaching and weathering of phosphate that exists in the carbonate rocks, namely chalk and marl, which contains fish bone and teeth fragments (Moh'd 2000). Gehlenite and diopside are usually formed in calcareous clay at a temperature above 850 °C (Al-Shorman and El-Khouri 2013; Reccardi et al. 1999; Maggetti et al. 1991; Maniatis et al. 1983), while apatite resists firing temperature up to 1000 °C (Lafon et al. 2003). This may indicate that the oil lamps belong to the first class which were fired at temperatures around 900 °C. The absence of gehlenite and the presence of illite in the diffractograph of oil lamp (Qw 3.1) indicate an initial firing temperature of less than 850 °C. Dolomite exists in the second class as a minor phase, diopside and apatite as trace phases (Fig. 8b). Due to the high amount of dolomite in this group, diopside is developed instead of gehlenite. However, the low amount of diopside indicates that the oil lamps of this group were fired at a lower temperature compared to the around 850 °C of the first class. Sample Qw 5.1 is considered as an exception; the amount of plagioclase was higher and became a major component. Diopside amount was also higher and became a minor phase, gehlenite existed as a trace phase (Fig. 9c) indicating an initial firing temperature of about 900 °C. Finally, apatite is presented as a trace phase in the third class, dolomite as a minor phase and gehlenite as a trace phase in sample (Qw 2.1). This puts the third class in the same firing temperature range of the second one. In general, the initial firing temperature of the studied oil lamps ranges between 850 – 900 °C; this means that the same firing technology was probably used in their manufacture.

Geochemical investigation

The chemical results of the analyzed oil lamps and soil samples are summarized in table 1 below. All the investigated samples contain large amounts of CaO with an average of 22.75 %, i.e. the oil lamps were manufactured using calcareous clay. Moreover, the iron oxide content is relatively high, with an average FeO of 5.95 %. Thus the Roman potter used ferruginous calcareous clay to manufacture the oil lamps. In addition, the sample contains a considerable amount of P2O5 with an average of 2.6 %. The

source of this phosphorus is the fragments of fish teeth and bone that are present in the chalk and chalky carbonate rocks in the study area and the hill tops around (Moh'd 2000). The chemical composition of the collected soil samples from the study area shows that all of these samples are of calcareous origin too (Table 1). The plot of the major elements of both the oil lamps and the soil samples on the ternary diagram of SiO2 – Al2O3 + TiO2 – alkalis + alkali earths shows that they are concentrated near the SiO2 – alkalis + alkali earths line, in the calcareous clay composition field (Fig. 10). However, the bulk chemical composition of a pottery sherd does not reflect the composition of a clay type. In fact, it reflects the composition of the clay and any other non-plastic materials (temper for example) (Mommsen 2004). Thus, the bulk chemical composition of the oil lamps reflects the components of the pottery paste that the Roman potters were prepared to manufacture their products. Usually, the raw clay is refined before its use, mixing two or more types of clay, and adding temper is possible. Thus it is better to compare the result with well known potters' pastes instead of raw materials. The lithology of Abila and its surroundings is characterized mainly by upper cretaceous carbonate sedimentary rocks that consist of the alternation of chalk, marly chalk, chalky limestone, marly limestone, and limestone (Fig. 2). In addition to that, chert beds and concretions are present. Pliocene to recent age basalts and tuff are exposed to the north and south east of the study area (Moh'd 2000). This lithology obviously reflects the composition of the investigated samples. The high amount of CaO (19.16 – 26.27 %) in pottery oil lamp sherds reflects the carbonaceous nature of the study area lithology. Again, the high content of P2O5 (2.11 – 3.17 %) reflects the existence of bone and teeth fragments in these carbonate rocks.

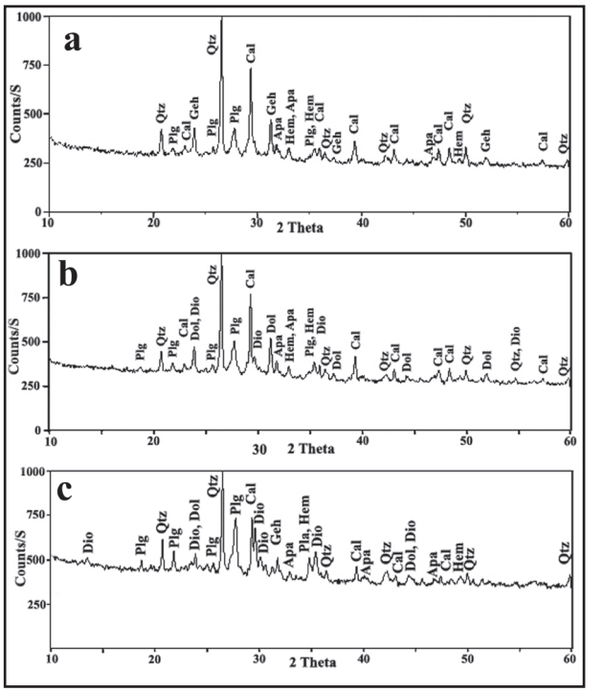

Fig. 9: Diffractographs show the minerals phases in the different classes. a: Qw 2.2, class 1; b: Qw 4.1, class 2; c: Qw 5.1, class 2.(Apa: apatite, Cal: calcite, Dio: diopside, Dol: dolomite, Geh: gehlenite, Hem: hematite, Plg: plagioclase, and Qtz: quartz).

However, in order to confirm whether all the investigated oil lamps are of native or foreign origin (i.e., imported), and to sharpen further the discrimination among them, the minor and trace elements of the oil lamps are also compared and plotted on the binary scattered diagrams. Figure 11 shows examples of such plots; all the plots, Zn – Mn, Cu – Cr, TiO2 - Cr and even the major oxides SiO2 – Al2O3, have revealed that oil lamp Qw 5.1 is out of the cluster. This indicates that oil lamp (Qw 5.1) was manufactured using different raw materials in the same locality or was imported, which is compatible with the result of the typological observations (see above). The typological observations also suggested that group Qw 4 oil lamps might just as likely have been imported. Contrary to such likelihood, however, mineralogical and geochemical

results indicated that this group has similar characteristics of the other groups (Qw 1, Qw 2, and Qw 3). This may mean that late Roman potters imitated imported oil lamps (group Qw 4) using local raw materials. Imitating some Western Roman pottery forms in the Eastern Roman provenances is not uncommon (Hayes 1972; 1997). The archaeological lexicon lacks detailed chemical analysis of the Roman oil lamps from Abila, and has eventually entailed visual descriptions only.

However, the only analytical study that investigated the chemical and fabric of oil lamps came from Roman Palestine (Lapp 1997). Lapp classified his collection into two groups; one was locally produced (Scythopolis or a site nearby), and the other was imported from another region in Palestine or Phoenicia. His study concluded that there was a trading connection between the commercial centers of the Decapolis cities; namely, Abila, Scythopolis, Gadara, and Pella; the littoral centers, such as Ashkelon and Caesarea Maritima; and the Galilee centers such as Horvat Hazon, Meiron, and Sepphoris.

Conclusion

The investigation of oil pottery lamps from Abila using both archaeological typology and archaeometry methods is an ideal approach for defining the provenance of the ancient pottery objects. This study revealed that Roman potters in northern Jordan (Abila is a good example)

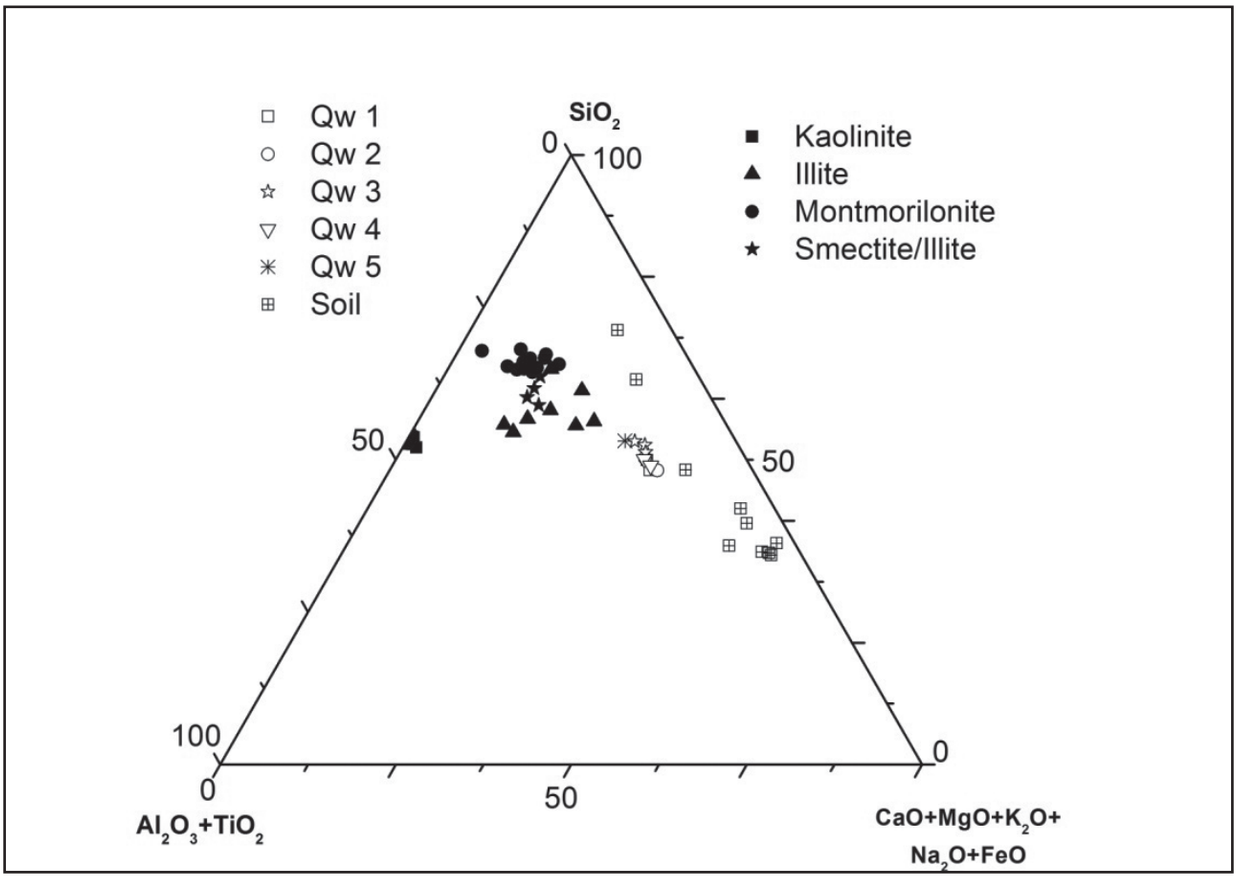

Fig. 10: Distribution of the ideal types of clay, Abila Late Roman oil lamps, and Abila soil samples on the SiO2 – Al2O3+TiO2 – Alkalis + Alkali earths ternary diagram. Note that both the oil lamps and soil are clustered near the calcareous field.

Table 1: Chemical composition of the oil lamps and the soil samples from Abila and its surrounding.

Sample No	SiO_2	Al_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O	FeO	P_2O_5	SO_3	LOI	Mn	Ni	Cu	Co	Cr	Pb	Zn	Sr	Cd
Qw 1.1	46.4	12.45	0.77	23.7	1.8	1.83	0.02	5.96	2.28	0.12	4.61	1125	2973.6	112	3509.7	665.1	237	787.06	104	62.5
Qw 1.2	44.3	12.67	0.78	23.51	2.4	1.73	0.02	6.31	3.17	0.06	4.99	983	2818.9	233	3616.2	819.3	83.5	597.18	64.6	32.5
Qw 2.1	46.9	12.51	0.85	23.18	2.4	1.24	0.01	6.18	2.97	0.05	3.68	1663	2451.7	172	1039	1135.5	7	859.39	81.2	8
Qw 2.2	44.4	11.72	0.82	26.27	1.8	1.41	0.03	5.57	2.67	0.07	5.17	1323	2941.7	170	2187.6	763.1	27.9	789.15	98.1	16.8
Qw 3.1	47.2	11.17	0.84	22.71	1.5	1.23	0.02	5.47	2.4	0.05	7.41	588.6	2355.3	170	476.1	884.07	43.8	682.35	2	34
Qw 3.2	48.9	12.37	0.94	20.44	1.7	1.66	0.11	6.1	2.31	0.05	5.48	698.5	2406.5	205	1442.7	658.9	83.6	842.71	32.6	29.5
Qw 3.3	46.3	11.65	0.81	21.44	3.1	1.23	0.03	5.84	2.65	0.09	6.91	959	2390.6	215	610.5	1170.6	55.2	780.17	8	38
Qw 4.1	45.3	12.31	0.86	22.54	2.3	1.45	0.1	5.6	2.69	0.05	6.84	1288	2345.6	191	1014.5	765.1	42.4	808.34	82.5	28
Qw 4.2	45.2	12.19	0.86	24.59	2.1	1.46	0.02	5.77	2.72	0.13	4.95	1158	2135	192	21	616.6	65.8	734.8	8	29.4
Qw 5.1	50.9	14.05	1.1	19.16	2.6	1.35	0.02	6.72	2.11	0.04	2	4565	2891.3	378	3343.2	1362.5	146	1464.9	57.3	32.8
Qw S1	34.6	4.31	0.16	53.97	5.9	0.36	0.01	0.44	0.05	n.d	n.d	903.4	42.06	17	0	33.87	n.d	222.6	n.d	2
Qw S2	39.5	4.97	0.22	46.17	8.2	0.24	0	0.46	0.06	n.d	n.d	602	42.86	17.3	4.8	79.5	n.d	226.1	n.d	2
Qw S3	34.3	4.23	0.08	51.08	7	2.63	0	0.44	0.05	n.d	n.d	1041	72.83	17.2	0	0	n.d	204.1	n.d	1
Qw S4	35.8	9.48	0.06	43.87	9.9	0.22	0	0.42	0.05	n.d	n.d	816	50.53	16.7	0	17.33	n.d	219.1	n.d	2
Qw S5	34.8	5.28	0.09	51.36	7.2	0.56	0.01	0.44	0.05	n.d	n.d	1038	44.7	17.2	0	30.58	n.d	216.2	n.d	2
Qw S6	36.2	2.5	0.09	52.5	7.8	0.2	0	0.42	0.05	n.d	n.d	1309	78.12	17.5	0	0	n.d	194.8	n.d	2
Qw S7	74.2	6.94	1.17	20.9	0	0.15	0.23	0.54	0.11	n.d	n.d	735	72.02	16.7	34.59	272.67	n.d	259.1	n.d	1
Qw S8	48.4	9.15	0.36	41.48	0	0.06	0.15	0.49	0.07	n.d	n.d	51	47.83	16.5	9.93	119.96	n.d	230.4	n.d	2
Qw S9	64.2	8.56	0.75	27.15	0	0.28	0.22	0.53	0.09	n.d	n.d	496	67.41	15.9	25.31	224.74	n.d	246.5	n.d	1
Qw S10	41.9	4.53	0.32	48.22	4	0.29	0.07	0.46	0.06	n.d	n.d	414	44.02	17.4	8.03	104.89	n.d	230.3	n.d	2

Oxides are in wt% measured using XRF, while elements are in ppm and measured using AAS

LOI : loss on Ignition / in house method

n.d: not detected

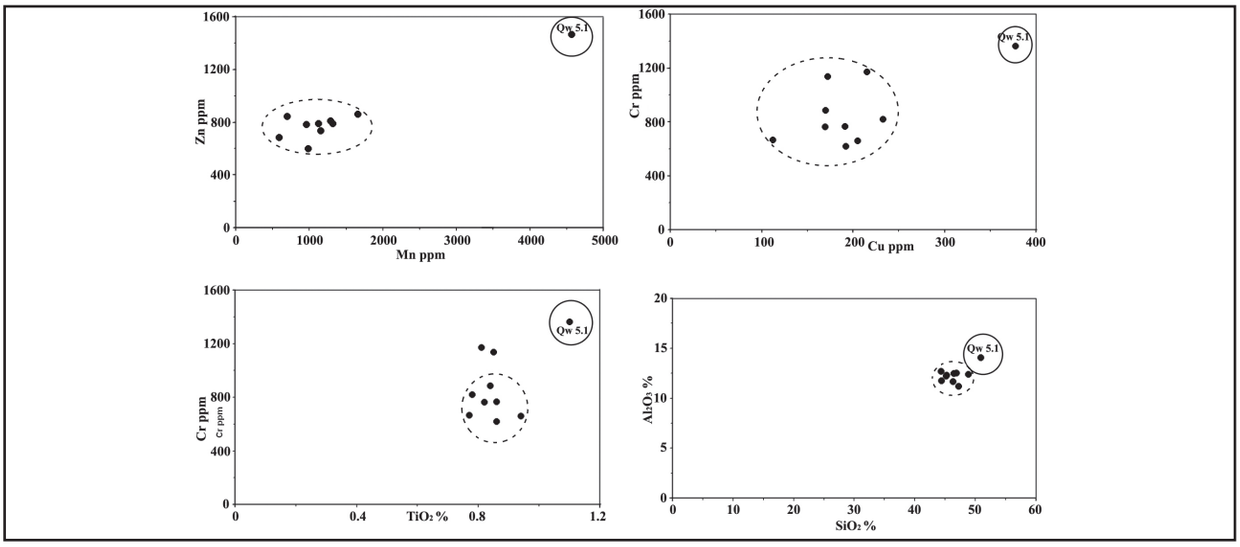

Fig. 11: Binary scatter diagrams of different major, minor, and trace elements. Note that in all diagrams oil lamp Qw 5.1 (in the open black circles) lies out of the cluster of the remains samples.

manufactured their own pottery lamps using local raw materials and techniques, as in groups (Qw 1, Qw 2, Qw 3, and Qw 4). On the other hand, they also imported few lamps; group (Qw 5). It seems that those potters had the required skills and expertise to imitate imported forms of pottery lamps using the local raw materials and techniques, as evidenced by all the locally produced lamps. Thus, among this small number of oil lamps, there is relatively large diversity and similarities to the lamp-forms that were found in the neighboring sites. This indicates that Abila in the Roman period had active trading relations with their neighbors, i.e. the southern Levant.

There is only one imported lamp in the studied lamp potsherds, which represents only 6% of the whole number of the sherds. Based on the high percentage of the whole pottery finds locally produced in Abila between the 1st and 3rd centuries AD., this low percentage can lead to credible generalizations. During this period, locally produced pottery seems to have been the major trend, and import seems less common. The imitation of the imported pottery lamps is an indication that the import of pottery was probably higher in the early Roman period; i.e., 1st century BC to 1st century AD. The increase of the production of the local pottery over time indicates that potters gained the required experience to produce their own products, which may contribute to the economic self-sufficiency in the whole Eastern Roman cities.

Lamia El-Khouri: Department of Archaeology, Faculty of Archaeology and Anthropology, Yarmouk University, Irbid, Jordan.

Ahmed Al-Shorman: Department of Archaeology, Faculty of Archaeology and Anthropology, Yarmouk University, Irbid, Jordan. *ahmedlf@yahoo.com*.

ملخص: يقوم هذا البحث على فحص مجموعة من الأسرجة الفخارية الرومانية، (وعددها سبع عشرة مسرجة)، من موقع أبيلا (قويلبة)، شمالي الأردن؛ وذلك بهدف تحديد المصدر الجغرافي لها، من خلال الفحص النمطي النوعي، والفحص المعدني، وفحص النسيج الدقيق، والفحص الجيوكيميائي. وقد أجري ذلك باستخدام تقنية البتروغرافي، وتقنية حيود الأشعة السينية (XRD)، وتقنية تفلور أو تألق الأشعة السينية (XRF)، وتقنية طيف الامتصاص الذريّ (AAS). قُسِّمت العيّنات المدروسة اعتمادا على الفحص الوصفي، والنمطي، وفحص الشكل، واللون، إلى خمس مجموعات. ومن خلال التحاليل الجيوكيميائية والمعدنية، تبين أن العينات يمكن ان تُقسَّم الى مجموعتين رئيستين؛ الأولى (وعددها ١٦ عينة) محلية الصنع من طين كلسي حديدي، والأخرى (وعددها عينة واحدة) مستوردة.

Notes:

(1) For more information and types of Roman pottery lamps made in Italy refer to (Bailey 1980).

References

Avigad, N. 1976. **Beth She'arim Report on the Excavations during 1953-1958, III: Catacombs 12-23**. Jerusalem.

Bailey, D. M. 1980. **A Catalogue of the Lamps in the British Museum**, Vol. 2: Roman Lamps made in Italy: British Museum. London.

Broneer, O. 1927. A Late Type of Wheel-Made Lamps from Corinth. **AJA** 31: 329-337.

Fuller, M. 1993. **Abila of the Decapolis: A Roman-Byzantine City in Transjordan**. 2 Vols. Ann Arbor.

Hadad, Sh. 2002. The Oil Lamps from the Hebrew University Excavations at Bet Shean. In G. Foerster and Y. Tsafrir (ed.), **Excavations at Bet Shean**, Vol. I. QEDEM Report 4.

Hayes, J. 1972. **Late Roman Pottery**. The British School at Rome. W. Heffer and Sons Ltd. Cambridge.

Hayes, J. 1997. **Handbook of Mediterranean Roman pottery**. British Museum Press. London.

Lafon, J.; Champion, E.; Bernache-Assollant, D.; Gibert, R. and Danna, A. 2003.

Thermal decomposition of carbonated calcium phosphate apatites. **Journal of Thermal Analysis and Calorimetry** *72 (3)*: 1127 – 34.

Lapp, E. 1997. The archaeology of light: the cultural significance of the oil lamp from Roman Palestine. **PhD thesis**, Duke University. U.S.A.

Maggetti, M. 1982. Phase analysis and its significance for technology and origin. In*:* Olin, J. and Franklin, A. (eds), **Archaeological Ceramics**. Smithsonian Institution Press, Washington D.C: 121-135.

Maggetti, M.; Baumgartner, D. and Galetti, G. 1991. Mineralogical and chemical studies on Swiss Neolithic crucibles. In: Pernieka, E. and Wagner, A. (eds), **Archaeometry'90***:* 95-104.

Maniatis, Y.; Simopoulos, A. and Kostikas, A. 1983. Effect of reducing atmosphere on minerals and iron oxides developed in fired clays: The role of Ca. **Journal of the American Ceramic Society 66 (11)***:* 773 – 781.

McNicoll, A.; Edwards, P.; Hanbury-Tenison, J.; Hennessy, B.; Potts, T.; Smith, R.; Walmsley, A.; Watson, P. 1992. **Pella in Jordan I1**. The second interim Report of the joint University of Sydney and College of Wooster Excavations at Pella 1982-1985. Mediterranean Archaeology Supplement 2, Sydney.

Mohd, B. 1997. Geological map of Irbid 3155 II. Natural Resources Authority, Geological mapping Division, Amman.

Moh'd, B. 2000. **The geology of Irbid and Ash Shuna Ash Shamaliyya (Waqqas)**.

Map Sheet No. 3154-II and 3154-III. Natural Resources Authority, Geological Mapping Division, Amman. Bulletin 46.

Mommsen, H. 2004. Short note: Provenancing of pottery-the need for an integrated approach. **Archaeometry** *46 (2)*: 267 – 271.

Riccardi, M. P.; Messiga, B and Duminuco, P. 1999. An approach to the dynamics of clay firing. **Applied Clay Science** 15: 393-409.

Rosenthal-Heginbottom, R. 1995. Imported Hellenistic and Roman Pottery. In E. Stern (ed.), **Excavations at Dor, Final Report, IB: Areas A and C. The Finds**. QEDEM Reports 2. Jerusalem: 183-288.

Sellers, O., and Baramki, D. 1953. A Roman-Byzantine Burial Cave in Northern Palestine. **BASOR Supplementary Studies** 15-16: 7-55.

Al-Shorman, A. and El-Khouri, L. 2013. Archaeometric characterization of the Byzantine and Umayyad pottery at Barsinia, North Jordan. **Mediterranean Archaeology and Archaeometry** *13 (2)*: 207 – 220.

Wexler, L. and Gilboa, G. 1996. Oil Lamps of the Roman Period from Apollonia-Arsuf. **Tel Aviv** 23: 115-131.