The Lower Egyptian Culture: new perspectives through the lens of ceramic technology

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This study aims at characterising the pottery tradition of the Lower Egyptian Culture to shed new light on the sociological landscape of the Delta region at the beginning of the 4th millennium BC. The analytical method chosen to address this issue is the chaîne opératoire *approach as it proved to be particularly well suited to define the local tradition and differentiate it from other productions in Middle/Upper Egypt and the Levant. The goal is to set the stage for future studies on its evolution through interactions with neighbouring regions. The results obtained by analysing pottery assemblages from Tell el-Iswid and Tell el-Samara and by comparing them to samples from Tell el-Fara'in/Buto show the presence of four chaîne opératoires; a local distinctive one of the Delta predominates and proves to be very different from those of Middle/Upper Egypt and the Levant. This local tradition was practiced at the domestic level, remained stable over time and testifies to a Lower Egyptian social group made up of communities linked by strong ties.*

Cette étude a pour objectif de caractériser la tradition céramique de la culture de Basse Égypte afin de jeter un nouvel éclairage sur le paysage sociologique de la région du Delta au début du IVe millénaire avant notre ère. La méthode analytique choisie pour répondre à cette question est celle de la chaîne opératoire, qui s'est révélée particulièrement bien adaptée pour définir une tradition locale et la différencier des autres productions de Moyenne/Haute Égypte et du Levant. L'objectif est de préparer le terrain pour de futures études visant à suivre son évolution au travers des interactions avec les régions voisines. Les résultats obtenus en analysant les assemblages céramiques de Tell el-Iswid et de Tell el-Samara et en les comparant à des échantillons de Tell el-Fara'in/Bouto montrent la présence

de quatre chaînes opératoires, dont l'une, particulière au Delta, prédomine et s'avère très différente de celles de la Moyenne/Haute Égypte et du Levant. Cette tradition locale était pratiquée au niveau domestique. Elle est restée stable dans le temps et témoigne d'un groupe social de Basse Égypte constitué de communautés liées par des liens étroits.

The term "Lower Egyptian Culture" (abbreviated LEC) defines the Predynastic groups that inhabited Lower Egypt during the 4th millennium BC.[1] Settlements and necropolises attributed to this culture have been detected in the Nile Delta, the Giza plateau, and the Memphite region down to the area of Sedment at the beginning of Middle Egypt.[2] All the excavated sites are characterised by a very similar material culture and by settlements and necropolises that share the same kind of organisation. This culture has been traditionally defined in opposition to that of Upper Egypt, also known as the Naqada Culture, as the materials of these two groups are completely different. However, until now, the possibility of regional differences or internal evolution has not yet been explored. Indeed, in the last thirty years, even though research has concentrated on the Delta and several sites have provided a large amount of new data, the pending questions on the internal development of the LEC sites and the links between them still persist. Moreover, if changes in the typology of the LEC ceramics are utilised to date the archaeological contexts, it is not yet clear whether these changes reflect deeper social changes.

In order to shed new light on the sociological landscape of the Delta region at the beginning of the 4th millennium BC, we carried out a technological analysis of the predynastic ceramic assemblages of two sites in the eastern Delta, Tell el-Iswid and Tell el-Samara, and we then compared the results with contemporary ceramics from Tell el-Fara'in/Buto. This approach is not innovative[3] but it has not yet been extensively implemented on Egyptian assemblages to address broader questions about social boundaries, interactions between groups and their subsequent evolution.[4] Its strength lies in its capacity to highlight social groups, a technical tradition requiring its transmission through a tutor usually selected within one's group, with the consequence that technological boundaries overlap social boundaries.[5]

The chosen sites, Tell el-Iswid and Tell el-Samara, are both located in the north-eastern Delta. Tell el-Iswid was occupied from the early 4th millennium BC, - period of the LEC (from Buto Ib/IIa) -, until the early 3rd millennium BC (Naqada III C) and with less-intense periods of occupation dating to the Old Kingdom and Late Period.[6] Tell el-Samara was inhabited from the Neolithic

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1. Maczyńska 2011: 880-882.

2. For an overview and detailed bibliography see: Bajeot 2017.

3. Roux 2016; 2019.

4. To date a few studies have been carried out to approach some very specific problems such as, for example, the process of making black-topped pottery: Hendrickx *et al.* 2000; Baba & Saito 2004; Baba 2009; Warfe 2015.

5. Stark 1998; Roux *et al.* 2017. The nature of the "social group" in which the same technical tradition is passed down is variable and can correspond, for example, to tribes, lineages, chiefdoms, groups, clans, factions, castes, sub-castes, professional communities, ethnic communities, ethno-linguistic groups, a population or a gender. The nature of these groups can normally be defined through the analysis of the archaeological context (Roux 2019).

6. Buchez *et al.* 2017.

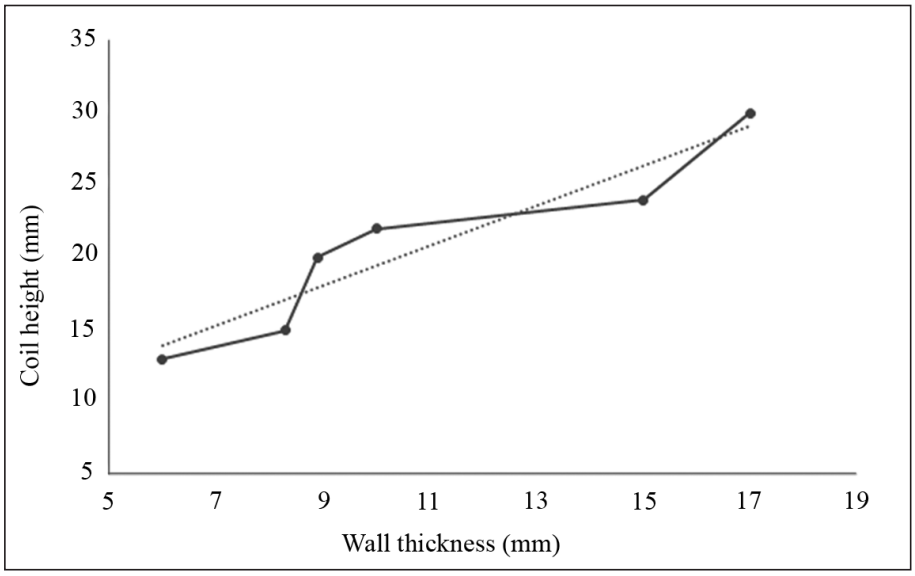

Fig. 1
The size of the coils is proportional to the wall thickness.

Period (possibly the end of the 5th millennium BC) to the beginning of the 3rd millennium BC (2nd Dynasty).[7] The layers identified so far at Tell el-Samara that date to the LEC correspond to Buto IIa-IIIa and possibly also to Buto Ib. Tell el-Fara'in/Buto is located in the north-western Delta and its archaeological deposit spans the whole LEC period, from Buto Ia to Buto IIIA, and continues without interruption through the Dynastic Period.[8]

Materials and Methods

The material of Tell el-Iswid comes from the layers of the predynastic settlement excavated in Area 4 (located in the south-western portion of the tell) and dates from Buto Ib-IIa to Buto IIb. The material of Tell el-Samara comes from Areas 1a and 1b of the settlement and dates to Buto IIa and b, with some portions possibly dating to Ib. Based on the morphological typology, the ceramic material of both sites is comparable with Buto Ib-IIb phases of Tell el-Fara'in/Buto,[9] and only the material belonging to the most ancient phase of both sites is comparable to that of Maadi (Buto Ib-IIa).[10]

The sherds are in a very fragmentary state of preservation and the morphological diagnostic pieces are few, making it difficult to attribute them to shapes. Moreover, many of them are eroded and the surface treatments are no longer recognisable, which has led to their exclusion from our analysis; nevertheless, their weight and thickness have been recorded.

At Tell el-Iswid 76 kg of ceramics coming from the Lower Egyptian Culture layers have been analysed, out of which 37 kg were eroded sherds and 39 kg (1.945 sherds) were kept for the technological analysis.

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7. F. Guyot personal communication.
8. Faltings & Köhler 1996; von der Way 1997; Hartung 2008.
9. von der Way 1997; Faltings 2002; Hartmann in press.
10. Rizkana & Seeher 1987; Hartung *et al.* 2003; Bajeot 2017.

At Tell el-Samara a total of 228 kg of ceramics were analysed, out of which a total of 109 kg of sherds were eroded and a total of 120 kg (5.391 sherds) were kept for the technological analysis.
The technological approach entails identifying the manufacturing *chaîne opératoire* on the basis of diagnostic macro- and micro-traces. The latter are interpreted by referring to experimental and ethnographic reference data.[11]
The technological analysis of ceramic assemblages is carried out following three successive sorting:[12]
1) The first sorting is by technical groups: they are defined by the manufacturing process as expressed by both the microfabrics and the surface features present on the inner and outer faces of the vessels (sherds or full vessels). Surface features are analysed with the naked eye and the optical microscope (up to 20x magnification); microfabrics are analysed on the radial, fresh sections of the sherds with an optical microscope (up to 40x magnification). It is at this stage that fashioning and finishing techniques, surface treatments and firing practices are characterised.
2) The second sorting is by techno-petrographic groups; that is, by petrographic groups within each technical group. This is accomplished by referencing the classification of the petrofacies present on the site (based on the properties of the fine mass and the inclusions). The sherds belonging to each technical group are examined in order to identify the class of petrofacies to which they belong and to characterise their petrofabrics in terms of the technological transformation undergone by the raw material. It is at this stage that the modalities for preparing the clay paste are studied and the ensemble of the *chaîne opératoire* is reconstructed, from the collection of the raw material to the firing.
3) The third sorting is by techno-morphological and stylistic groups, that is to say by morphological and stylistic types within each techno-petrographic group. It is at this stage that the range of vessels made according to a *chaine opératoire* is characterised. Within the framework of this study, the main morpho-functional types are indicated in order to assess whether the variability of the *chaînes opératoires* is functional or sociological. In the former case, the function of the vessels determines the variability of the *chaînes opératoires*. In the case of the latter, a same morpho-functional type can be made according to different *chaînes opératoires* and the variability reveals different social groups.

Results

The studied assemblages comprise four techno-petrographic groups whose percentage is given for each chronological period in Table 1:[13]
1) a largely predominant group called LEC-VEG (abbreviation for ceramics tempered with plant remains) (**Fig. 2**);

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11. Roux 2016; 2019.

12. Roux 2016: 257-280; 2019.

13. To date it is not clear if the quantitative differences between the two sites reflect real differences or if they should be attributed to a slight chronological shift caused by a dissimilarity in the distinction and characterisation of the *facies* in the two sites. The last hypothesis is perhaps the most probable considering that the study at Tell el-Samara is in its early stages and that in the domain of predynastic studies, the chronological sequence of the LEC has not yet been definitively established. Despite these differences, general trends shared by both sites are clearly visible.

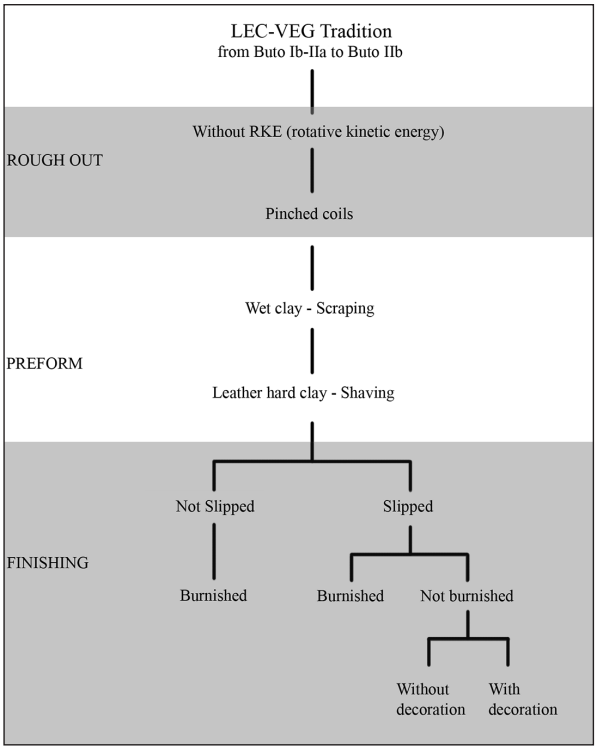

Fig. 2
Technical tree.
Diagram of the LEC *chaîne opératoire*.

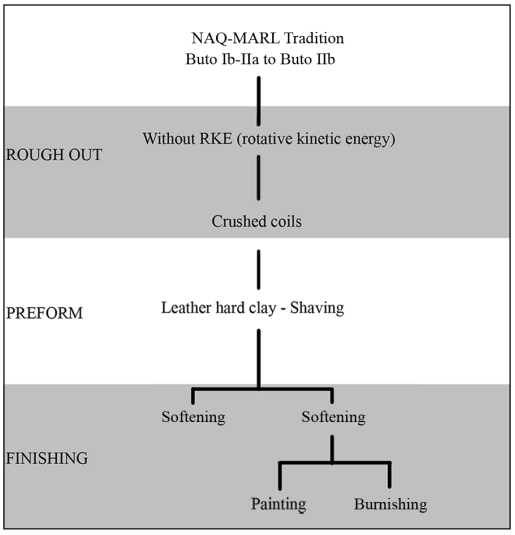

Fig. 3
Technical tree. Diagram of the NAQ-MARL *chaîne opératoire*.

2) an anecdotal group called FIBROUS (abbreviation for ceramics tempered with fibres);
3) an anecdotal exogenous group called NAQ-MARL (abbreviation for ceramics originating from the Nile Valley made with marl clay) (**Fig. 3**);
4) an anecdotal exogenous group called LEV-MIN (abbreviation for ceramics tempered with minerals and originating from southern Levant).
Each group is described below in terms of its *chaîne opératoire*. (**Table 1**)

Tab. 1
Number of sherds per techno-petrographic group identified in the ceramic assemblages of Tell el-Samara and Tell el-Iswid, period Buto IIa and Buto IIb.

TECHNO-PETROGRAPHIC GROUPS (Buto IIa)	Tell el-Samara Total Number	Tell el-Samar %	Tell el-Iswid Total number	Tell el-Iswid %
LEC-VEG	817	99%	970	100%
FIBROUS	5	0,6%	/	/
NAQ-MARL	2	0,2%	/	/
LEV-MIN	1	0,1%	/	/
TOTAL	825		970	

TECHNO-PETROGRAPHIC GROUPS (Buto IIb)	Tell el-Samara Total Number	Tell el-Samara %	Tell el-Iswid Total number	Tell el-Iswid %
LEC-VEG	2845	98%	474	95%
FIBROUS	29	1%	14	3%
NAQ-MARL	18	0,6%	5	1%
LEV-MIN	3	0,1%	4	1%
TOTAL	2895		497	

The group LEC-VEG

Preparation of the clay paste

The clay paste of the ceramics belonging to this group is characterised by a Nile clay composed of alluvial material tempered with plant remains (**Fig. 4a-f**).[14] The presence of fine sand is not intentional and, due to the gradient of the grain size, must be attributed to alluvial deposits. The firing temperature was probably around 800°C as the silica from the plant remains has disappeared.[15]

The dimensions of the organic inclusions vary in length from 0,3 to 7mm. The large variability of their dimensions does not allow for the subdivision of fabrics on the basis of their size and density, contrary to what has been previously proposed for the study of the ceramics of Tell el-Iswid,[16] which followed the same

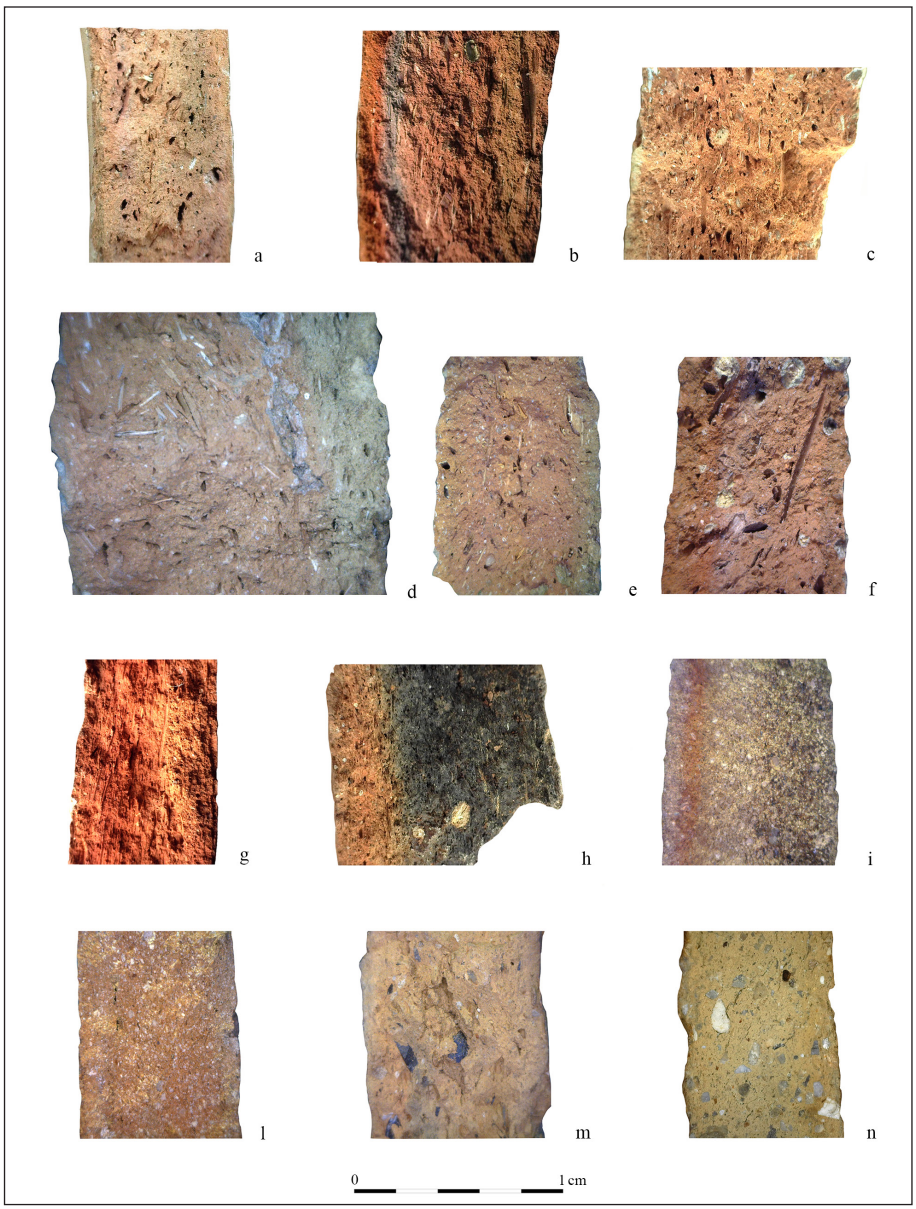

Fig. 4
Techno-petrographic groups:
LEC-VEG burnished a-c;
LEC-VEG slipped d-f;
FIBROUS g-h;
NAQ-MARL i-l;
LEV-MIN m-n.

14. M. Ownby, unpublished report.
15. M. Ownby, unpublished report.
16. Bréand 2014; 2015; Guyot 2014; 2015.

classical approach applied to the studies carried out in the Delta and in particular Nordström and Bourriau's classification.[17] As a general observation, the size of the organic inclusions varies from one vessel to another as well as within the same vessel, but the quantity of added organic temper remains stable around 20-25%.[18] Lastly, the paste is characterised by many large voids suggesting insufficient wedging to evacuate the air trapped in the paste.

Manufacturing process

The manufacturing process involved first forming the base from a spiralled coil. *Diagnostic features*: spiral fissures and spiral undulations on the surface and, in the radial section, elongated oblique fissures and obliquely elongated pores on either side of the centre of the base (**Fig. 5d-e**).

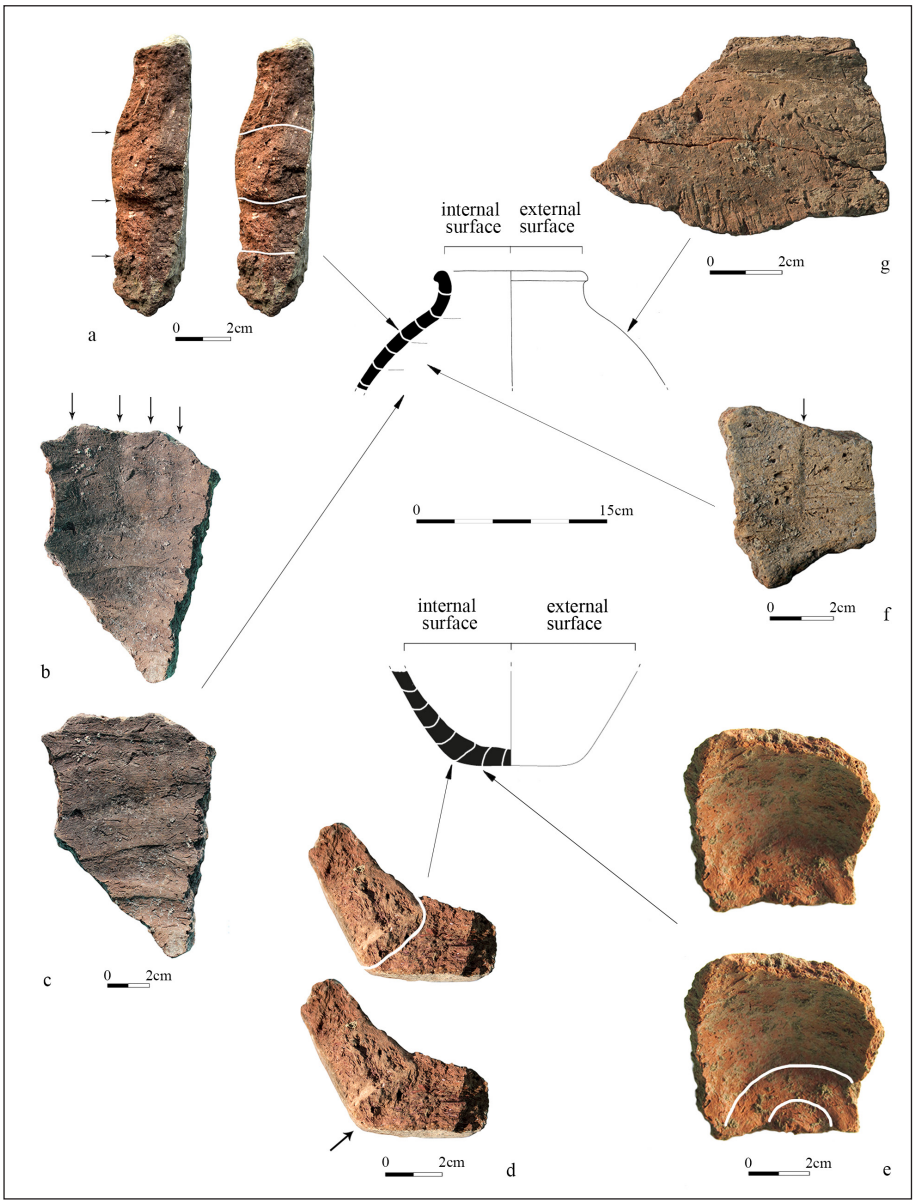

Fig. 5
Exemplification of the chaîne opératoire of the LEC-VEG production (rough-out and preform):
a) horizontal coils visible on the radial section;
b) vertical depressions caused by the use of the hand in support of the walls during the scraping operation of the outer face;
c) horizontal undulations visible and perceptible on the inner faces;
d) junction of the coil at the periphery of the base;
e) spiralled coil forming the base;
f) tool arrest mark left during the scraping operation;
g) oblique deep striations and compact micro-topography witnessing a shaving stage.
Elaboration of drawings made by Christiane Horchstrasser-Petit, Juliette Laroye, Julie Villaeys.

17. Nordström & Bourriau 1993.
18. The quantity of temper has been estimated on the basis of the quantification charts published in Courty *et al.* 1989.

The walls were formed by first placing a coil at the periphery of the base. *Diagnostic features*: preferential fractures and, in the radial section, a fissure at the junction between the body and the base (**Fig. 5d**).
The successive coils were placed on top of each other and joined by pinching (**Fig. 5a**). The height of the coils varies between 1,3 and 4 cm depending on the thickness of the pot walls (**Fig. 1**). The thicker the walls the larger the coils. Everted necks and rims were shaped by folding the coil outwards. *Diagnostic features*: horizontal undulations discernible on the inner faces, preferential horizontal fractures and, in the radial sections, polyconcavities aligned horizontally at regular intervals (**Fig. 5c**). The pinching technique is also visible in the weakly deformed poral structure characterised by a sub-circular pattern obtained when forming the coil.
The shaping was then realised by gradually scraping the inner and outer faces with a hard tool. *Diagnostic features*: presence of deep striations on the external and inner faces, tool arrest marks perpendicular to the striation bands on the inner faces and, finally, vertical depressions on the inner faces caused by the use of the hand to support the walls during the scraping operation of the outer face (**Fig. 5b,f**).
The inner faces were subsequently smoothed with the hands using horizontal gestures. *Diagnostic features*: very fine threaded striations, irregular micro-topography and "y" shaped or reticulated striations left by the fingers.
Once the paste was leather hard after a first drying stage, the outer faces of the containers were shaved with a sharp tool and the various base forms (flat, rounded and pointed) were finalised. On several sherds the shaving reaches the shoulder of the pot and, in one case (a small open form), the rim. *Diagnostic features*: deep striations, compact micro-topography (**Fig. 5g**).

Three different surface treatments followed (**Tab. 2**): burnishing, slipping and slipping and burnishing.

a) Burnished pots (Fig.6.a-c)
The burnishing can take the form of a covering or a pattern of overlapping or non-overlapping bands. It is characterised by a shiny surface that contrasts with the mat aspect of the non-burnished surfaces. For the closed vessels, the body is burnished vertically or obliquely, while the neck and the rim are burnished horizontally (for the latter, on the outer and inner sides). For the open vessels, the burnishing is found either on the inner face alone or on both the inner and outer faces. The inner faces are burnished horizontally, and the outer faces are burnished vertically.
Burnishing is the predominant surface treatment found in Tell el-Iswid and Tell el-Samara ceramic assemblages dating to Buto IIa. It is found on 76% of the LEC-VEG ceramics of Tell el-Iswid and on the 92% of those from Tell el-Samara. This predominance is even more marked when taking into account the eroded sherds. Indeed, a thorough analysis of the eroded sherds showed that most of them were burnished. Burnishing produces a film that is potentially very sensitive to post-depositional processes; it has a tendency to flake and disappear easily (**Fig. 6a-c**). This process is clearly visible on several sherds, on which tiny remains of burnishing were detected with a magnifying lens. These eroded sherds can be misleading as their surface can be easily confused with smoothed ones. In some cases when smoothing is indeed observable, it corresponds to the layer beneath the burnished layer. Finally, this very fragile burnished film can be easily mistaken for a slip because burnishing compacts

Fig. 6
Surface finishes of the LEC-VEG production:
a-c burnished sherds, the phenomenon of the erosion is also visible;
d-e slipped pottery; f slipped and burnished pottery.

the surface and makes the colour darker with firing. If the gloss disappears, the compact surface could then be confused with a slipped surface.
The functional range of burnished vessels is very large.[19] The open forms include numerous bowls with a tronco-conical or rounded profile of small, medium and large size (**Fig. 7**: CER18-013; CER18-11; CER18-005). The burnishing can be limited to the inside or, more rarely, present on both sides. Medium and large bowls with a thickened lip and very often decorated with a row of impressed or incised oblique notches below the rim are fairly common (**Fig. 7**: CER19-037; CER18-030). Some of these forms have very thick walls and the diameter of the opening can exceed 80cm. The closed vessels include small and medium jars with oblique and everted lips (**Fig. 7**: CER18-

19. The morphological and stylistic data of the LEC-VEG group is only related to the still ongoing study of Tell el-Iswid assemblages (Buchez forthcoming), as the typological analysis of the ceramics from Tell el-Samara is still in its early stages.

075; CER18-061; CER14-087; CER18-102; CER18-016) and medium jars with cylindrical necks (**Fig. 7**: CER18-027; 18-072). Despite the small dimensions of the sherds and their poor state of preservation preventing the attribution of the bases to specific types, most of the burnished bases are flat; however rounded bases have also been recorded. Among these burnished vessels, a few small globular jars with everted rims are decorated with a row of incised or impressed oblique notches below the neck (**Fig. 7**: CER18-024). This decoration has already been recorded in past excavation campaigns[20] and in other sites[21] and it would be typical of Buto Ib and the beginning of Buto IIa.[22]
The burnished vessels seem to be more characteristic of *facies 1* identified at Tell el-Iswid, corresponding to Buto IIa. In this *facies* the burnished pots constitute the majority of the assemblage. During *facies* 2, corresponding to Buto IIb, the number of burnished vessels decreases concurrently with the increase of slipped pottery. Some burnished forms persist (**Fig. 7**: CER18-027; **Fig.8** CER16-105; CER13-123; CER18-154; CER18-158; CER19-114), such as the simple bowls of various dimensions, while new shapes appear, such as the bowls with a convex profile and thickened rim bent inward (**Fig.8** CER16-105); others disappear completely, such as the basins with impressed and incised notches below the thickened rim and the small globular pots with incised notches below the rim.

b) Slipped vessels (Fig. 6d-e)
The dried pots are slipped with liquid, finely sieved clay. Thin and threaded striations indicate that it is applied on the outer face with the hands. *Diagnostic features:* floating grains and crests created by the accumulation of the liquid slip (**Fig. 6d**).
The slipped vessels include a limited range of types, represented by small and medium closed pots with a roughly developed neck, everted rim and possibly a pointed base (**Fig. 7**: CER18-021); small jars with a cylindrical neck and pointed base (the so-called lemon shaped jars) (**Fig. 8**: CER16-021; CER18-099; CER18-156; CER18-157); bowls with a rounded profile (**Fig. 7**: CER18-153) or tronco-conical profile and everted rim (**Fig. 8**: CER 18-155); large jars with very pronounced shoulders and everted rims (**Fig. 8**: CER18-84; CER18-85); and large open forms characterised by a slightly restricted opening and an oblique lip (**Fig.7**: CER18-003; CER18-004; CER18-004b).
A few vessels (see **Tab. 2**) are decorated with patterns of incised lines and impressed dotted lines that cover the whole pot body, except on the rim and the base (**Fig. 8**: CER13-473; CER13-459; CER13-271; CER13-292; CER13-306). The decorations are made after the application of the slip because the slip is absent in the decoration grooves. The incised linear or impressed dotted motifs are limited to a small but constant quantity of small and medium jars with

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20. Guyot 2015: 9.

21. See for example the sites of Tell el-Farah'in/Buto and Maadi (Rizkana & Seeher 1987; Von der Way 1997; Faltings 2002; Hartung *et al.* 2003; Bajeot 2017).

22. The reference chronology of this article is the one elaborated by Nathalie Buchez through the analysis of the ceramic assemblages of Tell el-Iswid (Buchez forthcoming). N. Buchez identified three *facies* (*facies* 1, 2 and 3) that have been put in correlation with the recent chronological reassessment of the ceramic material of Tell el-Fara'in/Buto made by Rita Hartmann (Hartmann in press) and with the general chronology adopted by the scientific community. Iswid *facies* 1 corresponds to Buto Ib-IIa (Naqada IIA-B?); Iswid *facies* 2 to Buto IIa/b-IIb (Naqada IIC beginning of IID); Iswid *facies* 3 to Buto IIIa (Naqada IID beginning of IIIA1). Notwithstanding that the study of the ceramic corpus of Tell el-Samara has yet to be completed, it has been possible to attribute the assemblages to the two main chronological phases Buto IIa and Buto IIb.

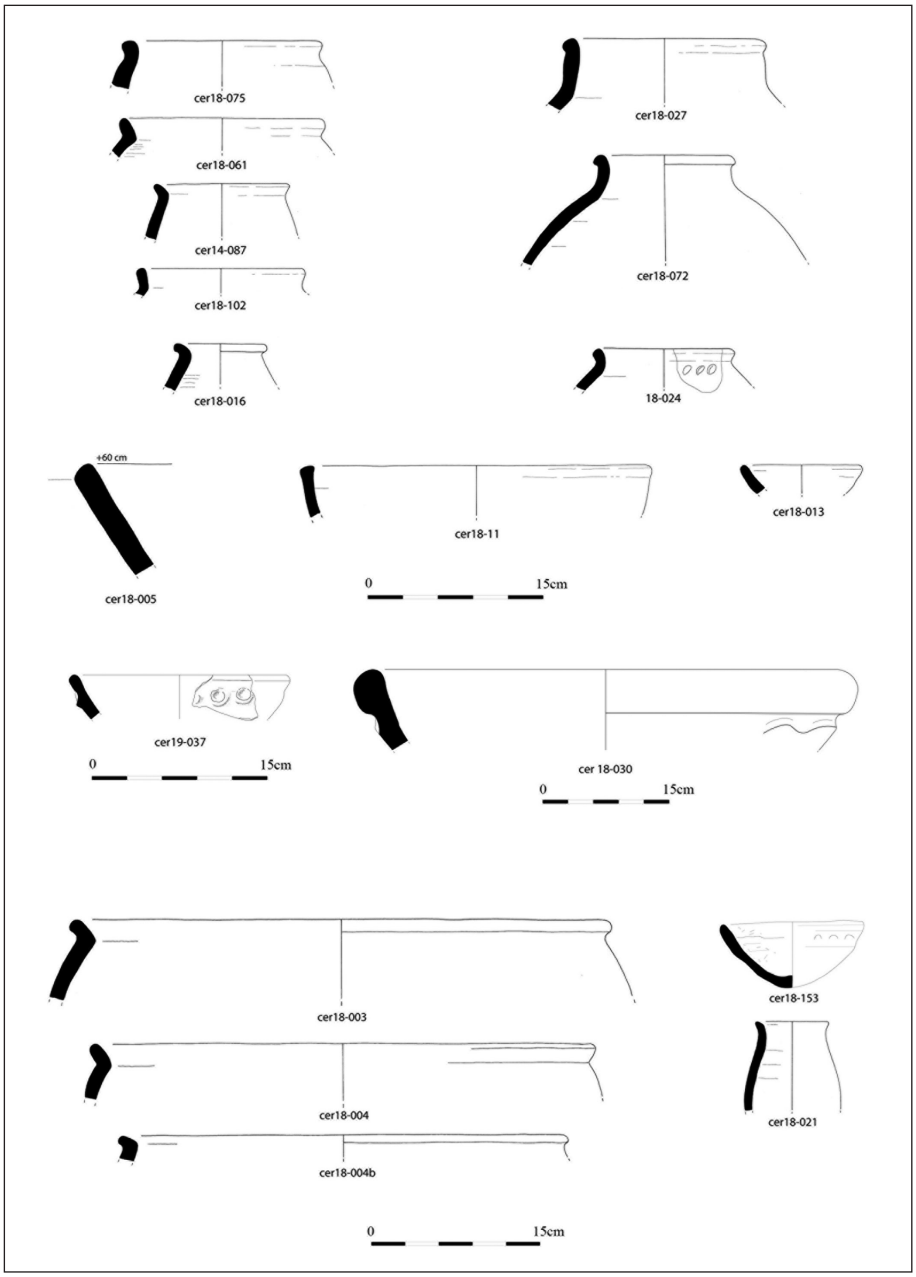


Fig. 7
Most representative types of the LEC-VEG groups, *facies* 1.
Drawings by Christiane Horchstrasser-Petit, Juliette Laroye, Julie Villaeys.

everted rims, oval bodies and flat or rounded bases, whereas a row of impressed crescents can be found below the lip of small bowls with everted rims.[23]
The number of slipped ceramics belonging to the Buto IIa layers of the analysed sites is in the minority (7% at Tell el-Samara and 23,5% at Tell el-Iswid),[24] but it increases to around 30-50% of the total sherds during Buto IIb.[25]

23. For an overview of the decoration patterns see: Guyot 2015: Fig. 19.
24. As already specified in footnote 5, the quantitative differences between the two sites cannot be considered in relation to real differences between Tell el-Samara and Tell el-Iswid at this stage of the study of the internal chronology of these sites and, more generally, of the sites of Lower Egypt. It is in fact possible that we are facing a bias caused by a different internal distinction of the *facies* and by the lack of a well-defined general LEC chronology. Nevertheless, similar general trends are clearly visible in all the considered sites.
25. This data confirms what has been previously noticed by F. Guyot (Guyot 2015: 8-9).

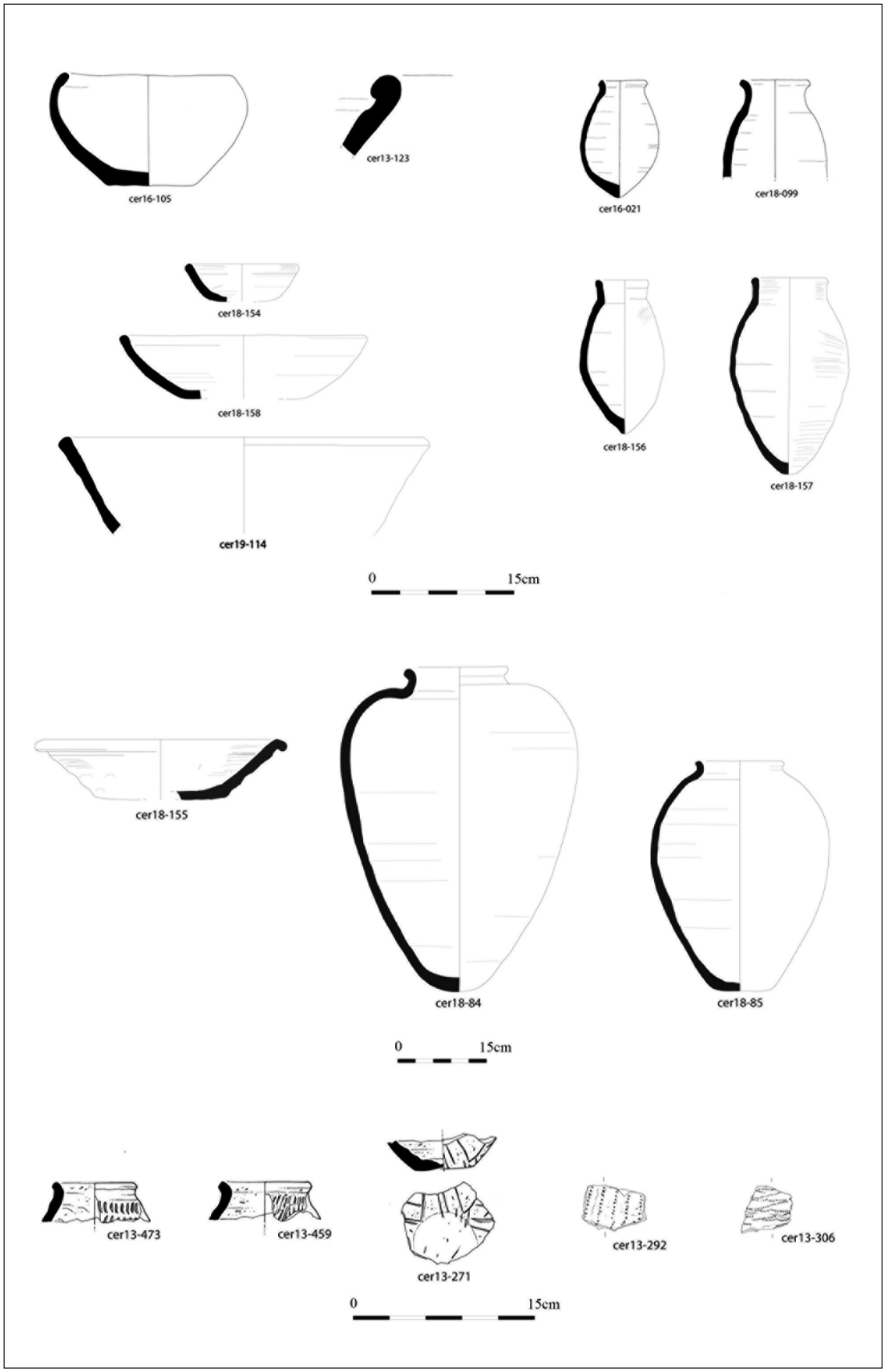


Fig. 8 • Most representative types of the LEC-VEG groups, *facies* 2.
Drawings by Christiane Horchstrasser-Petit, Juliette Laroye, Julie Villaeys.

More precisely, at Tell el-Iswid the pots described above become more common during *facies 2* (Buto IIa/b-IIb), when the slipped ceramics rose to 47 % of the production. Appearing in *facies 2* are the decorated jars, the so-called lemon jars and the large jars with very pronounced shoulders and everted rims.[26]

c) Slipped and burnished vessels (Fig. 6f)

They are represented by sherds characterised by a thick layer of slip with calcareous inclusions limited to the inner face. These sherds are normally poorly preserved, but on several of them it has been possible to see that the inner slipped surface is burnished. The little calcareous fragments always show an abraded and smooth surface. This group includes one single type of vessel that to date is only known in Maadi,[27] Tell el-Fara'in Buto,[28] Tell el-Iswid and Tell el-Samara.[29] These are very large oval basins (the diameter usually exceeds 60 cm) with flat bases and direct simple rims. The inner face is covered by a thick slip and a dense texture of tiny calcareous fragments that probably had a functional purpose. This group is represented by very small quantities of sherds that are consistently present in every assemblage dating to the beginning of Buto IIa. These pots have a very limited chronological distribution: at Buto they appear in Buto Ib layers but disappear during Buto IIa.[30] At Tell el-Iswid and Tell el-Samara they have been recovered only in the oldest layers, possibly corresponding to a late stage of Buto Ib or to Buto IIa.[31] (**Tab. 2**)

Tab. 2
Percentages of the different surface treatments of the LEC-VEG ceramics from the Buto IIa and Buto IIb layers.

Buto IIa				
LEC-VEG surface treatments	Tell el-Samara Tot. number	Tell el-Samara %	Tell el-Iswid Tot. number	Tell el-Iswid %
Burnished	756	92%	744	76,4%
Non decorated	756	92%	741	76%
Decorated	/	/	3	0,3 %
Slipped and burnished	2	0,2%	2	0,2%
Slipped	61	7%	228	23,5%
Non decorated	52	6%	228	22,5%
Decorated	9	1%	0	0%
TOTAL	**819**		**974**	

Buto IIb				
LEC-VEG surface treatments	Tell el-Samara Tot. number	Tell el-Samara %	Tell el-Iswid Tot. number	Tell el-Iswid %
Burnished	2102	74%	241	49%
Non decorated	2102	74%	241	49%
Decorated	/	/	/	/
Slipped and burnished	/	/	/	/
Slipped	743	26%	233	47%
Non decorated	558	20%	223	45%
Decorated	185	6%	10	2%
TOTAL	**2845**		**492**	

26. For the chronology adopted in this paper see footnote 22.

27. See: Rizkana and Seeher 1987: 42; Hartung *et al.* 2003: 183; Bajeot 2017: 86; Bajeot *et al.*, in preparation.

28. Faltings 2002: 107; Hartmann in press.

29. Fragments of these basins have been found during the campaigns carried out in 2018 at Tell el-Iswid and Tell el-Samara and have not yet been published.

30. Hartung *et al.* 2003: 183; Bajeot 2017: 196; Hartmann personal communication.

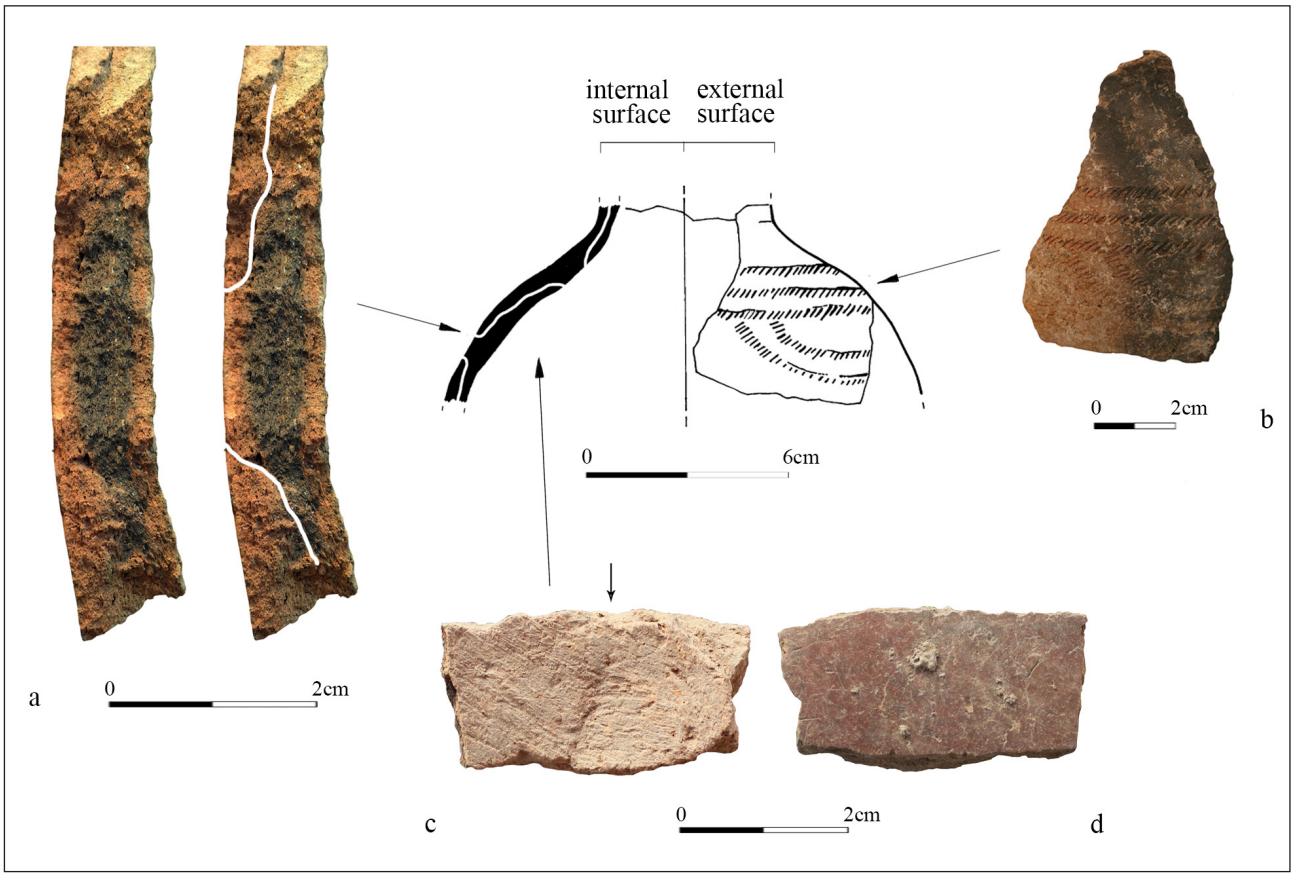
31. For the chronology adopted in this paper see footnote 22.

The firing of all the LEC-VEG ceramics was carried out in open firings as demonstrated by the heterogeneity of the surface colours, ranging from red to brown or black, and by the presence of smoke stains. The absence of a complete re-oxidation of the fabrics, testified by fractures whose margins and core are dark, either brown or with brown margins and black cores, suggests that the pots were removed from the fire before they cooled down.

The group FIBROUS

This group is in the minority (**Tab. 1**). All the sherds retrieved are of very small dimensions and belong to body walls. They all show that they have been made according to the same *chaîne opératoire*. The clay is of alluvial origin and is tempered with an organic material consisting of very thin, long and curly fibres whose origin is still unknown (**Fig. 4g-h**). The walls are formed with coils whose very elongated oblique joints visible in the radial sections suggest that they were placed by spreading the coils alternately from the inside and from the outside (**Fig. 9a**). This technique is completely different from the pinching technique employed for the LEC-VEG ceramics as it implies different gestures.[32] Due to the small size of the sherds, only rarely has it been possible to measure the large coils (around 5,5cm but we do not know yet if these measurements vary with the thickness of the walls). The outer faces are slipped and entirely burnished. The colour of the outer face ranges from deep red to brown

Fig. 9
Exemplification of the *chaîne opératoire* of the FIBROUS production.
Elaboration of a drawing made by Christiane Horchstrasser-Petit. Photos by Jade Bajeot and Valentine Roux.



32. For photos of different coiling techniques see Roux 2016: Fig.1.16.

to black (**Fig. 9b-d**) and sometimes stains of different colours are present on the same sherd. In some cases, the shoulder of closed vessels is decorated with superimposed rows of tiny impressed crescents or oblique notches made with a sharp tool after the slipping process (**Fig. 9b**). The inner face is wet smoothed and characterised by bands of very thin and dense striations with multidirectional orientation, probably produced by the use of a hard tool (**Fig. 9c**). The radial sections show in most cases a thick black core thus indicating that the pots were rapidly taken out from the firing before the cooling process. Most of the retrieved fragments belong to body sherds, which makes the identification of the forms difficult. However, with the exception of one sherd,[33] all of them were probably closed pots as the burnished slip is found only on the outer face. The identified forms belong to typologically limited jars of small or medium dimensions (**Fig. 9**).
In the assemblages from Tell el-Iswid this type of pottery appears in *facies* 2 (Buto IIa/b-IIb), while at Tell el-Samara it seems to appear slightly earlier, in the layers corresponding to Buto IIa. Thus, in both sites, this production is found later than in Buto, where it is already present in the most ancient Buto IIa layers.[34]

The group NAQ-MARL
This group is anecdotal and exogenous (**Tab. 1**). The sherds are made of a calcareous fabric, composed of marl clay with 20% of calcareous minerals of homogeneous size; organic inclusions are extremely rare (**Fig. 4i-l**). This element shows that the clay was probably sieved or left to decant. The paste is well kneaded, as shown by its low porosity and dense texture. The body is made with coils fixed by internal apposition as demonstrated in radial section by the oblique junction of coils and elongated oblique porosity (**Fig. 10**). The height of the coils (around 0,7mm) is uniform and does not vary depending on the size of the vessel. The retrieved sherds are burnished (**Fig. 10**: CER 18-067), softened (**Fig. 10**: CER 18-031), or softened and painted (**Fig. 10**: CER 19-091). Softening is a surface treatment obtained by rubbing a hard and wet tool on the surface. The addition of water makes the surface extremely smooth and silky but not shiny. The sections are completely oxidized, indicating that the vessels were removed from the fire at the end of the cooling process and the homogeneous colours indicate a better control over the firing.
Most of the fragments belong to body sherds and could not be attributed to forms; however, some of the burnished sherds could be identified as belonging to bowls, some softened sherds to wavy handles jars, and some softened and painted sherds to D-Ware jars.[35]
The sherds identified so far can be attributed to the Naqadan tradition and probably originated in Middle or Upper Egypt. At Tell el-Iswid these sherds start to appear in the uppermost layers dating to Buto IIb.[36]

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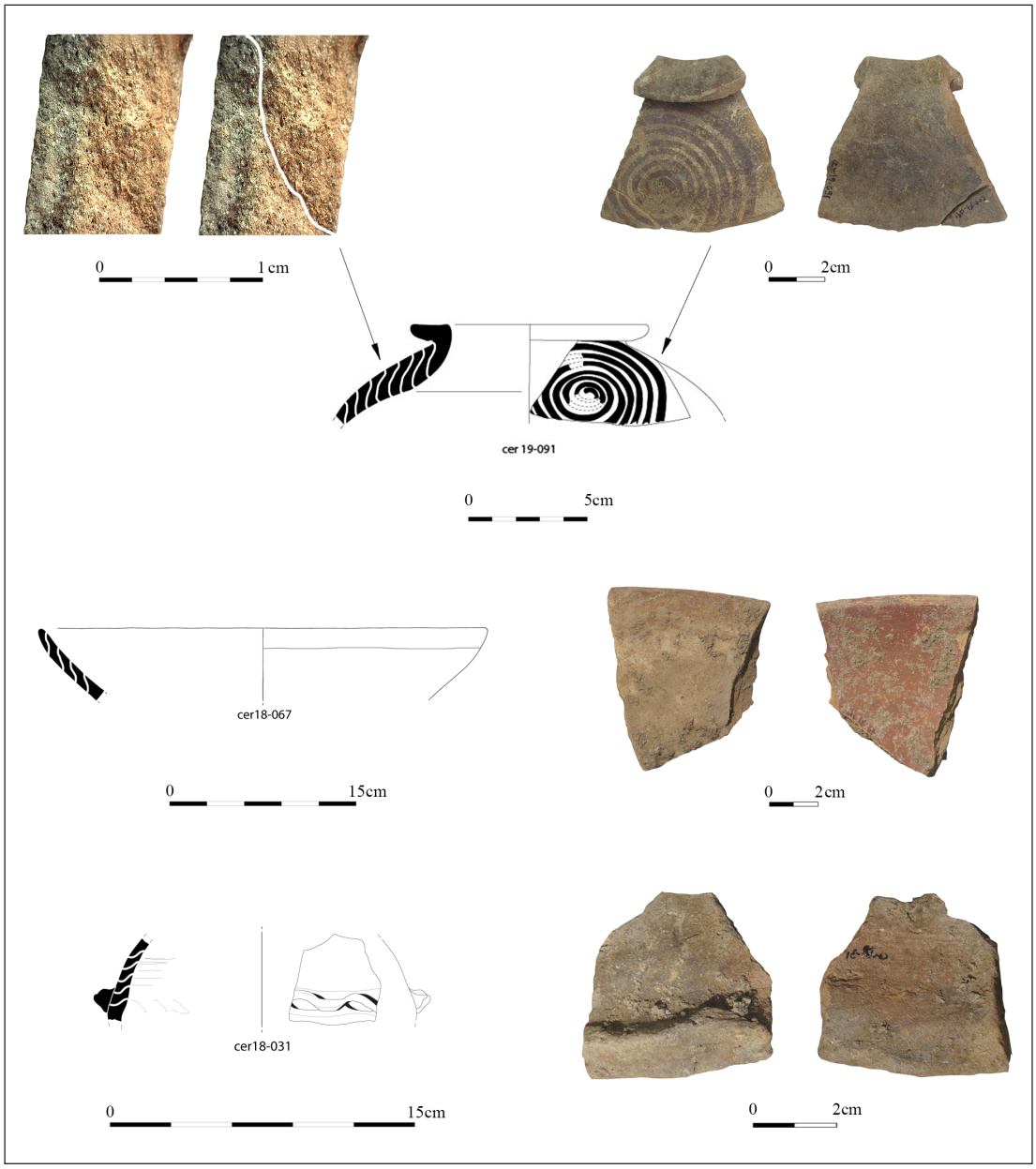
33. At Tell el-Samara a small rim fragment of a bowl has been identified. The sherd was burnished on both the internal and external surfaces.
34. Buchez forthcoming; Hartmann in press.
35. Notwithstanding the small quantity of NAQ-MARL sherds retrieved in the layers dated to the period under study, it was possible to carry out a detailed technological analysis by comparing these sherds to those coming from the following phase, Buto IIIa.
36. Buchez forthcoming.

Fig. 10
Exemplification of the *chaîne opératoire* of the NAQ-MARL.
Elaboration of drawings made by Juliette Laroye and Julie Villaeys. Photos by Jade Bajeot and Valentine Roux.



The group LEV-MIN

This group is also anecdotal and exogenous (**Tab. 1**). It includes sherds coming from the southern Levant. These ceramics are clearly distinguishable from the Egyptian production as they are characterised by a coarse fabric rich in crushed minerals (**Fig. 4m-n**). A detailed technological analysis could not be carried out on these sherds because of their small size. At Tell el-Iswid and Tell el-Samara these sherds start to clearly appear during Buto IIb, while at Buto contact with the Levant seems to be re-established only later, during Buto IIIa.[37]

37. Buchez forthcoming; Hartmann in press. At Tell el-Fara'in/Buto after the phase Buto Ia, during which we have a possible presence on site of people coming from the Levant, there is an absence of contact that lasts up to Buto IIIa (Hartmann in press).

Discussion

The technological analysis has highlighted four traditions: a predominant local tradition (LEC-VEG), a local anecdotal tradition (FIBROUS), and two exogenous anecdotal traditions, one from Middle/Upper Egypt (NAQ-MARL), and one from the southern Levant (MIN-LEV).

The diagnostic elements that differentiate these ceramic productions are the preparation of the clay paste and the roughing out techniques. The latter are particularly informative as the techniques for roughing out a pot do not affect its final shape – that can be obtained with different techniques such as pinched coils, spread coils, moulding, etc. – thus the method of choice is entirely related to the cultural tradition and its transmission from generation to generation. Consequently, forming techniques, learnt through long and tight relationships between tutor and apprentice, are stable over time and suitable for characterising a determined social group. Conversely, shapes and decorations can be learnt through individual study and mostly depend on the demand of the users. For this last reason they are more subject to rapid changes.[38]

The LEC-VEG represents the local tradition, therefore it can be regarded as the tradition practiced by the local inhabitants of the two sites during *facies* 1 and 2 of Tell el-Iswid[39] and phase 2 of Tell el-Samara (Buto Ib/IIa-IIb). In both sites almost half of the sherds could not be studied because of their surfaces were completely eroded. However, when examining their sections and making comparisons to this now well-identified group, we can suppose that they did belong to the LEC-VEG group, thus reinforcing the overwhelming presence of this tradition. Let us here emphasise that erosion has indeed affected a large number of sherds and rendered their surface treatments unrecognisable. This phenomenon is mostly due to the characteristics of the soil, thus to post-depositional activities, but it is also possible that the substances (e.g. oils, fermented foods, etc.) contained in the pots may have contributed to corrosion of their surfaces.[40] Corrosion seems to have affected more LEC-VEG sherds than those of NAQ-MARL and FIBROUS. The recognition of this phenomenon is important as the eroded surfaces could be mistakenly interpreted as smoothed surfaces and lead to an imbalance in the statistics.

The LEC-VEG local ceramic is characterised by a clay paste made of Nile silt tempered with plant remains, coiling using the pinching technique and open firing. It presents three main surface treatments: burnishing, slipping, and slipping and burnishing. Burnishing is found on a wide range of utilitarian vessels. This is particularly evident in the older layers identified in both sites and dated to Buto IIa, where most of the production belongs to this group.

In the following period the number of slipped pots increases. Contrary to burnishing, this surface treatment is limited to specific forms such as small

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38. Roux 2016; 2019.

39. For the chronology adopted in this paper see footnote 22.

40. The possibility that the poor preservation of the sherds could also be caused by the products contained in the pots has been highlighted by Vanessa Forte during an experimental reproduction and use of the LEC slipped and burnished basins. The LEC-VEG fabric is very sensitive to prolonged contact with acids that could be present in oily products, and would then cause it to flake apart (Bajeot *et al.*, in preparation).

and medium jars with everted rims, small jars with a cylindrical neck and pointed base (the so-called lemon shaped jars), and small bowls and large jars with very pronounced shoulders and everted rims. A limited but steady quantity of small and medium jars are decorated with patterns of incised linear or impressed dotted motifs on the whole body, and the small bowls are characterised by a row of impressed crescents below the rim.

Finally, the treatment that sees a slip with little calcareous fragments and burnishing is limited to very large and shallow basins that have a very limited chronological diffusion (Buto Ib-IIa).

The variability of the morpho-metric traits suggests that ceramic production was in the hands of multiple producers and therefore was made at the domestic scale. This local tradition shows continuity over the whole chronological timespan analysed here. Changes in surface treatments and in typology reflect evolutionary dynamics caused by consumer demand.

The LEC-VEG tradition has also been recently observed at Tell el-Fara'in/Buto.[41] There, despite the presence of more surface treatments,[42] the exact same *chaîne opératoire* has been identified in the layers dating from Buto Ib to Buto IIb. In this respect, it can be considered the tradition practiced by the Lower Egyptian Culture. It follows the hypothesis that the different groups living in the Delta had a common cultural substratum. The rationale is that they shared the same technical tradition and therefore were taught by individuals belonging to the same social group.

The FIBROUS group is characterised by a different *chaîne opératoire* than the LEC-VEG group. The clay is mixed with long curly fibres. The roughing out technique is achieved by spreading alternate coils and the ceramics are slipped and carefully burnished. In most cases these forms are attributable to medium closed jars, possibly used as cooking pots. These ceramics are found in very low quantities in all the sites of the Delta, as well as occasionally in Upper Egypt, but the place of production has not yet been identified.

The two anecdotal exogenous groups are represented by very low percentages of imports from Middle/Upper Egypt (NAQ-MARL) and from Southern Levant (LEV-MIN). These ceramics are made following different *chaînes opératoires* and in both the NAQ-MARL and LEV-MIN groups contact between the local groups and their southern and north-eastern neighbours is evident.

Particularly interesting is the fact that the NAQ-MARL tradition is completely different from the LEC one, making them relatively easy to distinguish from each other. The NAQ tradition is in fact characterised by the following traits: a very well-prepared kneaded fabric, the coiling by spreading technique, extremely compact and well-finished surfaces achieved in different stages of surface finishes, and a better firing. These indicators point toward a specialised production attributable to workshops.

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41. We thank Ulrich Hartung and Rita Hartmann very much for allowing Jade Bajeot to analyse several selected assemblages representing the whole LEC timespan of Tell el-Fara'in/Buto.

42. Hartmann in press.

Conclusions

The technological analysis of LEC ceramic assemblages has enabled us to characterise the regional tradition of the Delta in the beginning of the 4th millennium BC, and to differentiate it from other productions coming from Middle/Upper Egypt and the Levant. The four identified groups are each characterised by a different *chaîne opératoire*. Particularly telling are the differences in the roughing out techniques such as the coiling by pinching, by spreading and by alternate spreading, which all imply completely different gestures taught through different transmission networks.

The predominant LEC-VEG tradition was practiced on the domestic scale and remained stable over time, showing a strong continuity in the way of making a large variety of vessels. The changes in typology and in the relative proportions of surface treatments, particularly evident between Buto IIa and Buto IIb, are to be seen as an evolutionary dynamic sprung from user demand, perhaps related to a shift in food production and consumption. These modifications are in fact part of a larger phenomenon that sees changes also affecting the organisation of the settlement and of its spaces, with a shift in the orientation of structures and the appearance of numerous large storage facilities and, later, the construction of the first mud-brick buildings (Buchez forthcoming). Thus, this typological evolution would seem to be related to an internal process, possibly involving the whole Delta, and is not influenced, or at least not directly, by contact with the neighbouring regions[43]. In this phase (Buto IIb), in fact, contact with the Levant is evidenced by very low quantities of imported material and we have the appearance of the first few imports from the Nile Valley, both indicating loose connections.

In general terms the identification of the same *chaîne opératoire* in these three sites, together with similar technological and typological evolutions, shows how the LEC tradition was a unitarian tradition possibly derived from a common substratum, and proves that these groups kept close ties and interacted over time.

The retrieval of NAQ-MARL imported sherds allowed us to reconstruct the *chaîne opératoire* of at least part of the Naqadan production, which proved to be completely different from the LEC one (**Fig. 9-10**). The NAQ-MARL is a production issued from workshops as shown by the mastering of the manufacturing process (e.g. the preparation of a very fine and well-kneaded clay paste and a more homogeneous and careful firing). This is particularly important as the characterisation of both traditions already in these early stages of Tell el-Iswid and Tell el-Samara allowed us to follow the interaction of these two traditions over time. In fact, in 2019, we were able to start the analysis of Buto IIIa and Naqada IIIB assemblages at Tell el-Iswid and we saw on the one hand, an increase of the NAQ-MARL imports in the Delta during Buto IIIa, and on the other hand the appearance of some typical southern forms manufactured with a coarse clay tempered with plant remains, but following the NAQ tradition (e.g. coiling by spreading). In the assemblages dating to Naqada IIIB we were able to track down the outcome of this phenomenon, witnessed by the predominance of the NAQ tradition –repre-

43. These results seem to definitively exclude a possible western desert influence as proposed by I. Caneva (Caneva 1992).

sented by different groups of pottery locally produced by workshops with alluvial clay, that is to say southern potteries made following the NAQ tradition. By the same time, the LEC *chaîne opératoire* still persists for the local domestic production.[44]

New perspectives on the interactions of the Delta communities with their southern neighbours thus open up through a now more detailed view of the way an exogenous tradition came to replace progressively the local one.

Acknowledgments

This study was initiated during the campaign at Tell el-Iswid in 2017. The objective was to characterise the ceramic traditions of the Lower Egyptian Cultures and their evolution from the Buto period to the Naqada IIIA-B period. We would like to thank Nathalie Buchez, the Ministère de l'Europe et des Affaires *étrangères* and the Institut français d'archéologie orientale for making this study possible.

We also would like to thank Frédéric Guyot, Ulrich Hartung and Rita Hartmann for allowing us to study part of the ceramic assemblages from Tell el-Samara and Tell el-Fara'in/Buto.

44. A different paper will be dedicated to the illustration of the results of the analysis implemented on the assemblages dating to Buto IIIa and Naqada IIIB of Tell el-Iswid.

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