Purple dye production under royal management: Evidence from the Cypro-Classical citadel of Ancient Paphos

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PURPLE DYE PRODUCTION UNDER ROYAL MANAGEMENT
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Résumé. Au cours de la campagne de fouilles 2016 de l’Université de Chypre sur le plateau de Kouklia-Hadjiaabdoullah, des coquilles de murex ont été découvertes en nombre exceptionnellement important (430 kg), concentrées dans le complexe industriel (West Complex) qui occupe avec le « palais » (East Complex) la partie nord du plateau. Cette découverte inattendue nous a conduits, dans un premier temps, à établir un projet en coopération avec l’Institute for Aegean Prehistory (INSTAP) Study Center for East Crete, puis, peu après, à organiser en commun (1er-2 novembre 2019) un atelier sur le thème « The materiality of purple dye production and use in Cyprus and the Aegean from Prehistory to the Late Roman period ». Cet article constitue un rapport préliminaire sur le contexte de découverte et l’étude des coquilles trouvées dans le West Complex.

Introduction (M. I.)

Until recently, the involvement of Late Cypriot and/or Iron Age polities in the production of purple dye has not been given serious consideration. In “Shell Purple-dye Production in the Mediterranean Basin and Environrs”, David Reese catalogues six sites, not all of which have evidence for primary production. Suddenly, however, and almost simultaneously, material evidence for the production of purple dye was announced from the New Swedish Cyprus Expedition’s excavations at the coastal centre of Hala Sultan Tekke and from the Palaepaphos Urban Landscape Project’s (PULP) fieldwork on the plateau of Kouklia-Hadjiaabdoullah. PULP’s excavations on the plateau, which lies one km to the east of the megalithic temenos of the Palaepaphos sanctuary, were initiated in 2009.4

1. Reese 2019a; it is an unpublished catalogue compiled and periodically updated by David Reese and widely distributed by the author. Here we refer to the September 2019 version, which contains six entries including the two recent cases of Hala Sultan Tekke and Palaepaphos-Kouklia; the other four are: Pyrgos-Marvoraki, Polis-Marion, Kourion and Enkomi.
3. For the initiation (in 2006) and the goals of the Palaepaphos Urban Landscape Project (PULP for short), Iacovou 2008, 2013.
4. Iacovou 2019 with figures. Also, Fig. 1 in Iacovou, Karnava this volume.
Paphos, renamed Palaepaphos after the establishment of Nea Paphos further to the west, was one of the most prominent and resilient poleis (city-states) of the island. Despite the fact that the extremely rich burial record allows us to follow the impressive development of Ancient Paphos since its foundation as a port authority in the Late Bronze Age, the urban centre had remained largely invisible. It was assumed that it would have spread around the sanctuary of the Cypriot Goddess, which was later addressed as Aphrodite. However, other than the modern village of Kouklia that spreads to the north, and the mediaeval manor house, which was erected a hundred metres to the south of the temenos, the agricultural plots around the sanctuary contain sections of only three widely dispersed monuments at the localities of Marchello, Hadjiabdoullah and Evreti. The character of each one of these three localities, and their relation to each other, constitute one of PULP’s key research questions in relation to the polity’s urban structure in the second and first millennia BC. Furthermore, what one sees on the plateaus of Marchello and Hadjiabdoullah are sections of impressive stone-built monuments that have not been adequately excavated. To this day, their ground plans, hence also their extent and function in the urban landscape, are insufficiently known.

10. PULP’s 2006-2008 excavations on the plateau of Marchello have revealed the NW branch of the monumental rampart: cf. Iacovou 2013, p. 282-285, fig. 3.
The plateau of Hadjiabdoullah and the East and West Complexes

Despite the presence of a listed monument on Hadjiabdoullah, which had been discovered by the Kouklia expedition in the early 1950s (Fig. 1: plot 140), the rest of the extensive plateau was leveled with mechanical means and was used for the cultivation of cereals until 2009, when PULP was granted permission to carry out excavations in plot 139 to the west and south of the listed monument. Because of its elaborate construction with cut stone, the monument is thought to have served as a royal residence. Thus, it has since been labelled ‘the Late Archaic palace’. Nevertheless, it is only partially excavated and its ground plan is far from comprehensible.

PULP’s fieldwork to the west of the ‘palace’, which we have now labelled East Complex, revealed another well-designed complex, which extends over 65 m. along the north side of the plateau. The preservation of the West Complex, whose walls stand up to 1.5-2.0 m., is largely due to the fact that it is primarily built down the north slope of the plateau with the help of retaining walls. All its cross-walls abut on the external side of a substantial peribolos wall that was preserved under a modern dirt road.

To this day, we have excavated over 590 sq.m of the West Complex (close to 35% of its total extent) and have identified eight distinct units, whose architectural layout and material remains suggest that they operated within a purposely designed and built multi-functional industrial edifice (Fig. 2). The ceramic evidence suggests that the construction of the West Complex was contemporary with that of the East Complex. Hence, the two monuments appear to have been part of a major development project geared towards the establishment of a new citadel. Such an ambitious project could only have been

12. Maier 2004, p. 74-76, figs 58-59. Also, Hermary 2013, p. 92. Although its content has not been published, the earliest pottery from inside the building dates to the late Cypro-Archaic period.
14. Fig. 2 in Iacovou, Karnava this volume.
implemented by the dynasty that was in control of the city-state of Paphos around 500 BC.\textsuperscript{15}

The plateau of Hadjiabdoullah was therefore the administrative and economic center of the Paphian polis in the Cypro-Classical period. It would have retained its citadel status for two hundred years, until the royal dynasty of Paphos was exterminated by Ptolemy Lagos shortly before the end of the fourth century BC.\textsuperscript{16} The West Complex was definitely in use throughout the 5\textsuperscript{th} and 4\textsuperscript{th} century BC and, apparently, some parts of it, were still being used, though not necessarily for their original purpose, as late as the 2\textsuperscript{nd} century BC.\textsuperscript{17}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure3.jpg}
\caption{3D rendering of Unit 2 (before it was emptied of all the purple shells) showing the collapsed debris in SW corner. V. Trigas, PULP®.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure4.jpg}
\caption{3D rendering of Unit 2 (after it was emptied of all the purple shells) showing floor of mudbrick tiles and collapsed debris in SW corner. V. Trigas, PULP®.}
\end{figure}

The purple shells’ unit

In 2016, after removing the debris from the collapsed walls and roofs that had sealed a small internal room since antiquity, we came across a thick layer of purple shells. In 2017, following the establishment of a collaborative project with the Institute for Aegean Prehistory (INSTAP) Study Center for East Crete, study of the shells was entrusted to Dimitra Mylona.\textsuperscript{18} The collection and water floatation of the entire content of Unit 2 took

\begin{itemize}
\item \textsuperscript{15} ‘[A] new place-making strategy’ by a new dynasty (Iacovou 2019, p. 222).
\item \textsuperscript{16} Nikokles was the last king of Paphos; his tragic death happened in the archonship of Hieromnemon, i.e. in 310/9 BC (cf. Michaelidou-Nicolaou 1976, p. 25).
\item \textsuperscript{17} Dr Antigone Marangou, who is in charge of the amphorae project, has identified a considerable number of imported 3\textsuperscript{rd} and 2\textsuperscript{nd} c. BC amphorae fragments in Units 1 and 3.
\item \textsuperscript{18} The authors wish to express sincere thanks to Dr Tom Brogan, Director of the INSTAP Study Center for East Crete, for his support of the project.
\end{itemize}
three more seasons. We can confirm 100% recovery of the unit’s shell content with a minor exception: in the SW corner of the room, a section of the collapsed episode was left \textit{in situ} as a visual statement of the depositional event (Fig. 3). Under this one-and-a-half metre mass of stones, plastered upper floor fragments and large tiles from the roof of an upper story, there are still a couple of buckets of purple shells.

The actual floor level of Unit 2 was not reached until 2019, and it provided a pleasant surprise: the 20 cm-thick deposit of crushed shells was lying on a floor made of finely laid-out mudbrick tiles (Fig. 4). The pottery from Unit 2 belongs to small and medium-size vessels of types known to have been circulating during the (late) 4\textsuperscript{th} and (early) 3\textsuperscript{rd} century BC.\textsuperscript{19} Irrespectively of the date of the collapse of the West Complex, the abandonment of the purple shells in Unit 2 occurred at the end of the 4\textsuperscript{th} or early in the 3\textsuperscript{rd} century BC.

In 2019, from the circulation corridor that runs along the east side of Unit 2, an ostracon was discovered with a syllabic inscription that lists quantities of an unidentified product.\textsuperscript{20} It is the first indisputable evidence that supports the maintenance of accounts on the citadel of Ancient Paphos.

* * *

\textbf{Study of the shells (D. M.)}

The purple shells that formed a thick layer on the floor of Unit 2 are certainly no food leftovers. Such archaeological concentrations of Muricidae shells\textsuperscript{21} are commonly linked, directly or indirectly, to purple dye production.\textsuperscript{22} The deposit presents a number of challenges regarding its analysis and interpretation in the context of the industrial complex of the citadel and the broader political economy of Ancient Paphos. What follows is a preliminary report that focuses on (a) the molluscan assemblage and the insights it provides regarding the exploitation of marine resources in the region of Palaepaphos, (b) the process of purple dye production and (c) the significance of the accumulation of crushed purple shells within Unit 2.

PULP’s excavation of the West Complex employs a systematic soil sampling routine and uses water flotation for the collection of all bio-archaeological remains and small finds. The full recovery of the shells and the undisturbed character of the shell assemblage allow us to suggest that we are dealing with a complete, closed deposit. For this reason, precise quantification of the material is particularly useful. It is based on the estimation

\textsuperscript{19} The ceramic material from Unit 2 does not contain any amphorae fragments; it is currently under study by Dr Anna Georgiadou, PULP’s Iron Age ceramic specialist. See also Iacovou, Karnava this volume, note 24.

\textsuperscript{20} Iacovou, Karnava, this volume.

\textsuperscript{21} The family Muricidae is represented in the Mediterranean by three species of marine molluscs that produce purple dye: \textit{Hexaplex trunculus}, \textit{Bolinus brandaris} and \textit{Stramonita haemastoma} (cf. Houart 2001). The common name purple shell is generic and describes all of them.

\textsuperscript{22} The literature on the topic is wide. Indicatively, see Macdonald 2017, p. 61-64; Reese 2019a; Reese 2019b.
of the Minimum Number of Individual (MNI) shells.\textsuperscript{23} Although we have weighted the whole of the assemblage, which weights 430 kgs, we have counted and recorded in detail only half of the material; for the rest the recording was more basic. However, the numbers given in this preliminary report are calibrated for the whole of the assemblage.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|}
\hline
\textbf{Taxon} & \textbf{MNI} & \textbf{\%} \\
\hline
\textit{Bittium} sp. & 176 & 47,6 \\
\textit{Buccinum} sp. & 1 & 0,3 \\
\textit{cf Anomia ephippium} & 5 & 1,35 \\
\textit{cf Nucella} sp. & 1 & 0,3 \\
\textit{Conus} sp. & 11 & 2,3 \\
Coral & 2 & 0,5 \\
\textit{Crepidula} sp. & 1 & 0,3 \\
\textit{Gibbula} sp. & 7 & 1,9 \\
\textit{Hinia} sp. & 2 & 0,5 \\
\textit{Jujubinus elenchoides} & 8 & 2,2 \\
\textit{Mitrella} sp. & 3 & 0,8 \\
\textit{Nassarius} sp. & 8 & 2,2 \\
\textit{Pisania} sp. & 6 & 1,6 \\
\textit{Polia} sp. & 18 & 4,9 \\
Small unidentified & 3 & 0,8 \\
\textit{Arca noae} & 1 & 0,3 \\
\textit{Bolinus brandarisi} & 3 & 0,8 \\
\textit{Cerithium} sp. & 2 & 0,5 \\
\textit{Patella} sp. & 2 & 0,5 \\
\textit{Phorcus} sp. & 1 & 0,3 \\
\textit{Fasciolaria lignaria} & 3 & 0,8 \\
\textit{Euthria cornea} & 102 & 27,6 \\
\textit{Chama} sp. & 1 & 0,3 \\
\textit{Fussinus} sp. & 3 & 0,8 \\
\hline
Total & 370 & 100 \\
\hline
\end{tabular}
\caption{Hadjiabdullah, Unit 2. Taxonomic representation of molluscan remains other than \textit{Hexaplex trunculus}.}
\end{table}

\textsuperscript{23} MNI is here based on counting of columellae. Columella is the spiral column at the center of each shell. It is a unique feature of each individual and durable enough to provide an accurate estimation of the minimum number of individuals, especially in this case (Claassen 1998, p. 106-107; Giovas 2009).
Figure 5. Unit 2. Taxonomic representation of molluscan remains other than Hexaplex trunculus; taxa in blue are smaller than 1.5 cm in length, taxa in orange are larger. Total number of individual shells: 744.

Figure 6. Unit 2. Size distribution of complete purple shells (Hexaplex trunculus).

Figure 7. West Complex Unit 2. Typical sample of crushed purple shells (Hexaplex trunculus).
It is calculated that the assemblage is made up of circa 50,000 individuals. It is pure, consisting almost exclusively of *Hexaplex trunculus* shells. It includes only 744 additional assorted marine shells (*Table 1*; *Fig. 5*). The majority of these are very small in size (1cm in length or less). They are not edible and they do not bear any type of modification (e.g. perforation for use in jewelry). Among the largest taxa of the assorted marine shells the *Euthria cornea* is the most common. It is a carnivorous species that does not produce any dye. *Euthria* shells are typically found in association with purple shells, particularly *Hexaplex trunculus*, in assemblages that are related to purple dye production.\(^{24}\) Most of the *Euthria* shells have been found broken. The assemblage also included a few dozen fish bones, most of them catfish (cf. *Clarias* sp.), and also some carbonized seeds, almost exclusively olive stones.

The majority of the purple shells are heavily crushed (*Fig. 7*). The complete shells are all very small in size (*Fig. 6*). Most shells larger than 2.5-3.0 cm in length were crushed. Although there is no way to estimate the original size of the fragmented shells, the thickness and robustness of the majority of fragments suggests that, for the most part, it ranged from 3-6 cm in length. Fragments of larger individuals are also present.

The whole of the assemblage is contained within Unit 2. There is no spill-over outside this room. In fact, in the area of the industrial complex that has been excavated so far only a handful of seashells of any kind have been retrieved, and none is a *Hexaplex trunculus*. It appears, therefore, that a large amount of crushed purple shells were brought in and stored in Unit 2; they may have been lowered down into it from the floor above, which would explain the complete absence of purple shells in the corridor that runs along the east side of the unit. The floor (use layer) of Unit 2 contained almost nothing else when the shells were put there. There were two working platforms on opposite sides (east and west), and at least two pounders. There were also, a few small-size pottery vessels. The sheer volume of the shells definitely suggests a systematic collection of purple shellfish, and this can be safely linked to purple dye production.

**Insights into the purple dye industry at Ancient Paphos**

A purple dye workshop requires a steady and relatively sizable supply of live shellfish.\(^{25}\) Purple shellfish can be gathered by a number of methods, including diving and netting, but in the past the most efficient way was the use of baited baskets.\(^{26}\) These were most probably used for the fishing of the molluscs found in Unit 2 since capture appears to have been indiscriminate; it included other carnivore species, especially the *Euthria cornea* and even the smallest of *Hexaplex trunculus*, none of which offer any dye. This would not have happened if the shells were collected by hand. The use of net is

\(^{24}\text{Alfaro, Mylona 2014; Apostolakou et al. 2016.}\)

\(^{25}\text{See Alfaro, Mylona 2014 and Macdonald 2017 for a comprehensive description of the purple dye processing stages, including the ones discussed here.}\)

\(^{26}\text{Ruscillo 2005.}\)
plausible but it would be too inefficient and unreliable for the capture and processing of large amounts of shellfish.\textsuperscript{27}

Crushing of the shell is one way to access the hypobranchial gland, i.e. the part of the animal that produces the dye.\textsuperscript{28} Crushing is a fast and efficient way to do this. The flesh was subsequently removed and processed to produce the purple dye. This type of crushing, however, does not result in tiny shell fragments like the ones from Unit 2. In this case, deliberate pounding must have been employed, which created large quantities of finely crushed shells.\textsuperscript{29} Such a process would explain not only the small size of fragments in the Unit 2 assemblage but also the crushing of other shells such as the \textit{Euthria cornea}. As this mollusk does not produce any dye there would be no reason for it to be crushed. The fragmented shells of the molluscs were apparently accumulated somewhere near the purple dye workshop for further use. There are several archaeological examples of such accumulations, which form the most easily recognizable features of a purple dye workshop.\textsuperscript{30} At that stage, some of the other finds in the Unit 2 assemblage might have been mixed with the shells: the tiny molluscs, the fish bones and the carbonized olive stones that may represent fuel for the processing fires.

The process of purple dye production requires space, fuel, water and proximity to the shore and the shells.\textsuperscript{31} It leaves behind a strong foul smell and large amounts of waste. In and around a purple dye workshop, one would expect to find a scatter of whole and crushed shells, along with numerous objects that were used in the process. The excavated part of the industrial complex provides ample evidence for activities that required fire, water, as well as pounding or grinding activities. However, hearths (Unit 4), drains (Units 5-6) and basins (Units 3 and 8) are found distributed in other units, but not in Unit 2, which is situated between a store of wine amphorae to the south (Unit 1) and a room with finely cut drains (Unit 5) leading to a bathtub installation to the north (Unit 6). Hence, the complete absence of purple shells in any other area of the complex leaves no doubt that the production of purple dye took place elsewhere.

Geological studies, undertaken by Senior Geological officer Zomenia Zomeni in the context of her doctoral thesis, have demonstrated that the coastline, which now lies at some distance below the citadel and the sanctuary of Palaepaphos, has undergone significant transformations due to river silting and coastal uplift.\textsuperscript{32} Almost certainly, in antiquity, the coast would have been closer to the citadel and it would have included a protected anchorage, since Ancient Paphos was founded as a gateway to the sea in the Late Bronze Age.\textsuperscript{33} Therefore, a purple dye workshop (or workshops) could have existed on the now invisible coastline of the ancient \textit{polis}. 

\textsuperscript{27} For a detailed discussion of the possible capturing methods, Alfaro, Mylona 2014.
\textsuperscript{28} Spanier, Karmon 1987.
\textsuperscript{29} Aygün 2016, p. 117, pl. 44.
\textsuperscript{30} Indicatively see Karmon, Spanier 1987; Forstenpointner \textit{et al.} 2007.
\textsuperscript{31} See note 25.
\textsuperscript{32} Zomeni 2012.
\textsuperscript{33} Iacovou 2012.
The crushed shells found in Unit 2 were, therefore, brought on site from the production workshop and stored on the floor of Unit 2. Sacks or baskets made of perishable materials could have been used for this purpose. Bulrush (*Juncus* sp.) pytoliths and terebinth (*Pistacia* sp.) wood charcoal found within Unit 2 could potentially have been what survived of such containers.\(^\text{34}\) Both are traditionally used in basketry.\(^\text{35}\)

Consequently, what we have in Unit 2 is a cache of homogenous, clean, crushed purple shells that were kept for secondary use. It is likely that the crushed shells would have been used for the production of lime plaster. Such a use is well documented archaeologically from as early as the Bronze Age.\(^\text{36}\) The use of lime plaster is extensively manifested throughout the West Complex: floors and walls appear to have been regularly plastered.\(^\text{37}\) Perhaps the crushed *Hexaplex trunculus* in Unit 2 were stored in view of a refurbishment of the workshops; a refurbishment that never took place, probably because, at the end of the 4th century BC, the last of the Paphian kings, Nikokles (325-309 BC), was executed by Ptolemy Lagos and activity in the industrial complex was disrupted.

**Conclusions**

Written sources repeatedly emphasize the association of purple dye with royalty and priesthood.\(^\text{38}\) The evidence from Ancient Paphos, where the kings provide written confirmation of their dual authority,\(^\text{39}\) seems to agree with this statement: Nikokles and his predecessors of the dynasty that had apparently established the citadel and the industrial complex on Hadjiabdoullah are addressed on their inscriptions as *basileis* (kings) of Paphos and *hieraeis* (priests) of the *wanassa*, the Cypriot goddess.\(^\text{40}\)

Historical conclusions should be avoided in the context of preliminary reports and ongoing research projects. However, to the extent that the abandonment of Unit 2 as a post-extraction storage for the shells can be dated to the end of the 4th or the early 3rd century BC, it is difficult not to associate it with the tragic death of the royal family of Nikokles,\(^\text{41}\) which marked the end of the autonomous *polis*-state of Ancient Paphos. It is

\(^{34}.\) Georgia Tsartsidou, who has taken a substantial number of phytolith samples from the complex, has identified the presence of bulrush in Unit 2. Maria Ntinou, who studies the carbon samples from the West Complex, identified wood charcoal of terebinth.

\(^{35}.\) For the use of these materials in Cypriot traditional basketry see http://www.mcit.gov.cy/mcit/chs/chs.nsf/page8f_gr/page8f_gr?OpenDocument.

\(^{36}.\) Brysbaert 2007.

\(^{37}.\) Plaster samples from the walls and floors of the complex will soon be analysed by Marta Lorenzon to see if lime derived from marine shells was used in the plaster mix.

\(^{38}.\) Moatsos 1932, esp. p. 129-136. See also, Marín-Aguilera, Iacono, Gleba 2018, p. 145 with reference to its association ‘in the east with royalty and priesthood’.

\(^{39}.\) The dual authority was a characteristic of Cypriot kingship (cf. Hermary 2014); in the case of Paphos, however, it is also expressed on fourth-century BC royal inscriptions (cf. Satraki 2012, p. for an illustrated catalogue).

\(^{40}.\) Cf. Maier 1989.

\(^{41}.\) Diodorus Siculus (20.21.1-3) describes how Nikokles and his entire family committed suicide inside the palace.
definitely an attractive chronological association with a historical episode, but for PULP
the most valuable conclusion is that a purple dye industry can be securely associated
with the political economy of the city-state of Paphos in the Cypro-Classical era. Whether
the Paphian kings were using the precious dye just for their own garments, therefore
as producers and consumers of a status symbol, or whether they traded in purple-dyed
textiles, this remains to be seen. One even wonders whether, in earlier days, Cypriot
kings could have included purple-dyed textiles in the tributes, which we assume they
had to pay to the Assyrians and later the Persians, especially during the Cypro-Archaic
period. However, studies into the production and consumption of purple-dyed textiles in
Cyprus have only just begun.

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42. ‘Purple-dyed textiles were widely used to pay tribute to both royal courts and temples,
according to administrative records in the Near East’ (Marín-Aguilera, Iacono, Gleba 2018, p.137).

43. Evidence for purple dye production from Marion comes from the Cypro-Archaic sanctuary
at Peristeries, which is largely dated to the 7th c. BC (Smith 1997, p. 90-91; Reese 2019a, p. 81).


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