Dyeing and Weaving Works at Isthmia

CHRYSOULA KARDARA

The ancient ruins on the Rachi, the hill which overlooks the Isthmian sanctuary, reveal that the occupants had developed a small industry devoted to textile making.

In studying the material of this site I have come to realize that the vats could not have been wine presses, as was first conjectured. Other remains of the Rachi were equally puzzling. This observation created some confusion: there seemed no adequate explanation of most of the remains on this hill.

A general survey of the ruins as they appeared in the course of their excavation and study is as follows. Scattered all over the excavated area of the hill are cisterns clearly intended for storing water. They occur in large numbers and in a variety of shapes and sizes. All are cut in rock and well cemented. There is also a well with steps and a side channel, cut in solid rock to a depth of 45 m. at least. The ambitious scale of these works suggests that the need for water on the Rachi was great. It looks as if most of the stored water of the cisterns was intended to be used in non-domestic activities.

Apart from these cisterns, the most peculiar remains on the Rachi are four small establishments, each consisting of a shallow rectangular tank, well cemented, and two circular vats (pl. 79; pl. 80, fig. 1). These vats, also well cemented, are side-by-side at one end of the tank. The bottom of the tank slopes slightly towards the vats. In one case the tank communicates with one of the two vats through a small channel; in another case a bath establishment forms part of the same unit. Small, more or less rectangular cisterns were found close to these tanks. These, too, are cut in the rock, but are not for storing water; the term “container” has been applied to them conventionally. The débris of ashes, found either in the fill or in the area near by, gives the only clue to their function. In certain cases these “containers” seem to be supplemented by large jars.

The fill of these remains contained an amazing quantity of loom-weights, mostly of Corinthian manufacture, which would indicate that the purpose of the peculiar works on the Rachi was closely associated with weaving. Apart from the loom-weights and the ordinary vases, mostly fragmentary, the fill of the Rachi contained a large number of pieces of big terracotta roof tiles, also mostly fragmentary, a number of pieces of marble tiles, jugs, amphora fragments (including stamped handles), lamps, a few coins, several mill-stones and grinders, cooking pots, a few vessels of peculiar shape, and a number of pierced stones.

The big terracotta and marble tiles cannot belong to the roofs of the poorly constructed small houses on the hill. These tiles, some of which definitely antedate the settlement on the Rachi, seem to have been carried there when no longer used in their original buildings at Isthmia. They do not seem, however, to have been used as building material on the Rachi, at least in the majority of cases. It seems, therefore, as if they were used independently of one another, as implements of some kind.

Among the other conspicuous features of the hill are several staircases cut in the rock, some of which preserve several steps; one has a broad ramp. The hill seems to have been approached by these staircases in 1959.

2 The view that these people were weavers has been expressed by Professor Broneer in the preliminary reports of the Excavations at Isthmia, *Hesperia* 24 (1955) 124ff; *Hesperia* 27 (1958) 17ff. In these reports Professor Broneer expressed certain doubts that grapes grown in the valley could be carried to the top of the hill to be made into wine (*Hesperia* 24 [1955] 128). The view of wine making was based on the vats which were among the peculiar features of the Rachi. These vats resemble wine presses, and had to be explained one way or another in these reports. The writer—who was responsible for the excavation on the Rachi—agreed with Professor Broneer that the people of the Rachi were wine makers.

3 Cf. *Hesperia* 27 (1958) pl. 7 d.

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1 I feel grateful to Professor Oscar Broneer for his kind permission to study the ancient ruins of the Rachi, as well as for reading, correcting, and discussing aspects of this paper with me. To Sir John Beazley I feel grateful for his generous help in matters of bibliography and for his criticism. To Professor W. F. Albright I am indebted for permission to illustrate pl. 80, fig. 2 (the dye-works at Debit). To Dr. Helene Kantor I am thankful for calling my attention to the dye-works at Tell Mor and to Dr. Moshe Dothan for his kind information regarding this site. To Messrs. Kraay, Jenkins, and De Ridder, I am indebted for their kind help regarding the Kyriaka coins; and to Mr. Leonidas Zographos, chemical engineer, for technical advices and suggestions. I am also grateful to the British Council for the scholarship which enabled me to prepare this paper.
cases, and also from the plateau on the west side. Prior to the settlement a small shrine stood on the highest point of the Rachi, at the spot which is now the western boundary of the excavated area. The settlement may have extended to the west. It may have comprised more water-works, tanks and vats, etc.; also stairways. But the part of the hill to the west of the small shrine is now completely cut away by ancient and modern quarrying. In spite of this alteration, the preserved staircases, which mark the hill on the north and south sides, suggest that the occupants were engaged in activities that attracted visitors from various parts of the Isthmus. The stairways give the impression that the people of the Rachi did their best to facilitate access to the hill, especially where it is rather steep.

The presence of several entrances to the settlement suggests commercial activities, and naturally the picture of a market place is brought to mind. But the ruins of the Rachi do not resemble any other market place in Greece. The lasting impression is that specific goods were once brought by various people to the Rachi, and perhaps sold there to the inhabitants of the hill; then, having been worked into suitable forms for use, were sold again to other people, or transported somewhere else to be sold. The loom-weights point to goods connected with the manufacture of textiles, wool, linen, etc.

If the settlement on the Rachi is explained as devoted to weaving, the only solution to the peculiar water constructions on this hill would be to associate them with dyeing. On the evidence of the ancient ruins at Debir (Tell Beit Mirsim) and the conclusions reached by Professor Albright regarding these ruins, we can now visualize the function of the ruins on the Rachi.

The ancient ruins at Debir present the following similarities to the ruins of the Rachi: 1) their fill contained large quantities of loom-weights; 2) they comprised several installations (pl. 80, fig. 2) which recall the tanks with vats of the Rachi; 3) near the vats the excavators found jars containing remains of a material which looked “like gray ashes”; 4) near the dye-works a large number of pierced stones were found.

The installations with vats at Debir exhibit the following scheme. There is a rectangular area, one end of which is occupied by two vats. This area and the vats were immediately recognized by Professor Albright and his native workmen as ancient dye-works.

Professor Albright was able to illustrate how the dye-works at Debir operated in antiquity on the analogy of a modern dye-works at Hebron: 5 slaked lime is first put into the two vats and is left to stand for two days. Decomposed potash is then added (these two materials help to fix the color). On the third day a small amount of dye is put into one of these vats, and twice as much of the same dye into the second vat. Then the yarn (or cloth) is given two baths: first in the first vat, then in the second vat. In order to obtain a better hue more baths are recommended. The pierced stones found at Debir are explained by the excavators as pressing weights; but no great stress is laid by them on this explanation. Indeed it leaves one point unexplained: why they were pierced? Similar stones were found on the Rachi. Apart from the hole, they are too small to be used for this purpose.

The dye-works of Debir and their modern counterparts at Hebron help us to understand the function of the installations on the Rachi. The two vats of the tanks on this hill seem to be basins where woollen yarn (or linen, perhaps) was dyed. The yarn was first soaked in alkaline water or in a kind of detergent.7 This process may have taken place on the platform, or in a jar. In one case it may have been done on a separate platform: a platform without vats was found next to a platform with two vats (pl. 79). Then the yarn was given successive baths in the two vats. When it was dyed, it was evidently laid on the platform again. Big tiles may have subsequently been laid on it to press the dye out for re-use. In one case the dye seems to have been collected into one of the two vats through a small channel. The dyed yarn was then rinsed and dried.

4 Albright in AASOR 21-2 (1934) 59-63; Albright, The Archaeology of Palestine and the Bible (New York 1933) 119ff; G. E. Wright, Biblical Archaeology (1957) 18ff; cf. also Albright, The Archaeology of Palestine 140, pl. 22 (Penguin Books, Harmondsworth 1949). Forbes (History of Technology I, 248) takes the dye-vats to be oil presses. The reason: they are not built to be heated. Albright, however, has made clear that dyeing at Debir was done by immersion. Forbes probably missed the earlier publications of Albright: he is willing to accept the Palestinian vats as dye-vats provided immersion was the main operation in dyeing. He admits that Gezer was an important center of dyers in ancient times (cf. also Forbes in Studies in Ancient Technology IV, 139).

5 Albright, The Archaeology of Palestine and the Bible 120; Wright, op.cit. 187.

6 Cf. Strabo 13:4, 14, 630.

The view that the settlement on the Rachi was devoted to dyeing as well as to weaving offers the clue to the ambitious scale of the water-works. For dyeing much water is needed. The presence of bathtubs on the Rachi suggests that the occupants gave themselves a thorough and comfortable cleaning after work, a privilege working classes have attained in highly developed modern countries.

Apart from dyeing, the settlement may also have been devoted to fulling (κνάβειν). In Greek and Roman times basins, πλυνοί or labra, were used for treading cloth. Instances of such operations have been found at Pompeii, Chedworth, and elsewhere.

The settlement on the Rachi dates from ca. 360 to ca. 240 B.C. The settlement at Debir dates from the seventh century B.C. That immersion was practiced in seventh-century Palestine and in Hellenistic Greece is not surprising, since this method is still used today in the Near East, and the native workmen were able to recognize immediately the installations at Debir as dye-works.

There are certain differences, however, between the dye-vats on the Rachi and those at Debir. On the Rachi the vats are cut out of the hillside, at the lower end of a sloping tank. These vats are open on top, have a narrow rim, and can be differentiated: vats communicating with the tank by means of a channel—evidently used mainly for expensive dyes, and vats not communicating with the tank—suitable mainly for inexpensive dyes. At Debir the vats are built of stone, are not connected with any tank, have a rather narrow mouth, and a broad, flat, rim. This rim has a circular channel provided with a hole in the bottom.

According to Professor Albright, the vats at Debir were used for expensive dyes, mainly purple. They seem to correspond to some extent to those vats on the Rachi which were connected with the tank by means of a channel: the circular channel with the hole in the bottom may have been used, as Professor Albright rightly suggested, for the splashed dye. It may also have been used, however, for the dye which was pressed out of the newly dyed yarn when this yarn was placed on the flat rim of the vat. This dye was collected again into the vat. The rims of the vats at Debir therefore seem to answer the requirements of small tanks.

In the spring of 1960 Dr. Moshe Dotham found new dye-works in Israel: at Tell Mor, near Ashdod (Azotos). According to Dr. Dotham’s kind information—the section is not yet final)—these installations comprise cisterns, vats, and a deep well containing thousands of murex shells, all built of stone in a hollow cut out of the hillside. The cisterns are plastered, or have plastered walls and floors laid with shells. The vats are also plastered. One of the cisterns is connected with one of the vats by means of a channel.

The dye-works at Tell Mor are contemporary with those on the Rachi: they date from the Hellenistic period. So far no heating installations have been noticed at Tell Mor, and immersion seems to have been practiced in Hellenistic Palestine as well as in Hellenistic Greece. The plant dye on which the installations at Tell Mor are based seems to be different from that at Debir (Tell Beit Mirsim). The channel connecting one of the vats at Tell Mor with the cistern recalls the dye-works found on the Rachi (pl. 79); so does the well.

At Isthmia, as well as at Tell Mor, a stream flows nearby. The dye-works, however, including a number of cisterns and a well, were constructed on a hill. The reason is obvious: dyeing implies drying. Whether from the Saronic gulf or the Corinthian, the Greek mainland or the Peloponnesos, the Rachi is always exposed to winds, mild, strong, or even violent. These winds provided a quick service for drying dyed yarns.

The dye-vats on the Rachi show that immersion was the main operation for dyeing in ancient Greece. We know from ancient literature that the dyes used were: the kermes (κόκκος), the madder (ερυθρόδανον), the seaweed (φύκος), the woad (ισαία), the saffron (κρόκος), the black oak-apple (κηκής), and other organic dyes. These dyes could have been used by the dyers of the Rachi. Apart from them, however, purple dyes may have also been in use on the Rachi. Among the movable finds of this hill the excavators found a few purple shells. Purple dye is also supposed to have been used at Debir and Tell Mor. If the dye-works of Isthmia are recognized not only as ordinary dye-works (βαφεία), but also as purple dye-works (πορφυρομακαφεία), the question naturally arises why Isthmia was chosen for this industry. In 1879 Lortet and Chantre recorded the refuse of two
purple factories (πορφυρεῖα), one in Attica, the other in Salamis.\textsuperscript{11} Evidence of a third purple factory near the Isthmus is found in literature: Plutarch mentions that Hermione in the Argolid exported purple dye as far as Persia.\textsuperscript{12} Laconia was known to have had another center which produced the best purple dye of Europe.\textsuperscript{13} In these factories the essential tissue was taken from the mollusk, the shells were then left on the beach.

The proximity of several purple factories to the Isthmus may have been of paramount importance. Hermione, however, presents another advantage. The region of Parnassos, where great numbers of sheep were pastured, is not far away and could supply a large part of the wool supplies needed by the people of the Rachi. The close communication between the occupants of the hill and the dealers from the mainland, the Peloponnesos, or arriving by sea, is illustrated by the various staircases which give access to the hill. The Rachi as a site presents still another advantage: fuller’s earth (creta fullerica, Pliny 17.46) can still be dug in large quantities on the north and south slopes.

Hermione was known for its exquisite purple dye, Corinth was known for the exquisite and exotic colors of its purple garments.\textsuperscript{14} Isthmia lies at a short distance from Corinth, the ancient reference to Corinthian garments may therefore be applied to garments manufactured on the Rachi.

Often the ancient references emphasize the shades of purple dye: black or dark blue, and red. We have references both in classic and oriental literature. A tablet from Ras-Shamra mentions quantities of wool dyed black-purple and red-violet.\textsuperscript{15} The Assyrians used the term takiliu for violet-blue and the term argamanni for crimson-red (Fasti of Sargon II, 142).\textsuperscript{16} We read of these colors in Biblical literature, too. In II Chron. 2:27 “purple crimson and blue fabrics” are mentioned; and a skilled dyer is praised. It has already been suggested that the Cretans and the Mycenaens introduced these fabrics to the Near East; and that the Phoenicians became subsequently most skilled in dyeing them.\textsuperscript{17} The streets of Tyre were well-known for a bad smell coming from the purple shops, but the city largely owed its prosperity to this industry.\textsuperscript{18}

The art of obtaining the two main colors, and various hues between them, was a carefully kept secret of the ancient dyers. There seem to be two main types of purple mollusks: 1) the purple mollusk (πορφύρα): the tissue of this mollusk produces a white fluid which turns to yellow, then purple (through oxidation); 2) the murex (κηρὺξ): the tissue of this mollusk changes to deep violet (photochemically). There is also another variety of mollusk the tissue of which produces scarlet red.

The excellence of the quality of the dye largely depended on the maceration of the mollusk and on the extraction of the dye tissue. The various hues were probably obtained by varying the dose, by breaking off the process, by both, or by mixing dyes of various mollusks. Solvents may have been used to obtain a desired hue, or to produce a fast color. They may also have been used for the extraction of various dyes—purple and non-purple. They may be the φάρμακα we hear of. The place in which the various dye hues were prepared in an ancient dye works was called φάρμακων. It is possible to recognize such a place among the ruins of the Rachi.

According to Plutarch, the purple dye of Hermione, although stored for almost 200 years before Alexander’s conquest of Persia, was very fresh.\textsuperscript{19} Plutarch gives the reason of this extraordinary preservation: the red color of this dye had been mixed with honey. Honey acts as a preservative of organic materials. That honey played a role in the preservation of purple dye can now be illustrated by an archaeological find. Among the movable finds of the Rachi is a vessel (pl. 81, fig. 6) which shows the following features: a cylindrical form, two handles, groups of vertical grooves on the inside (made before firing with a comb), a slit near the bottom (also made before firing), a name scratched on the outside (ΟΡΕΣΤΑΔΑ), and no sign of fire on the bottom. Mr. Pallas has identified this vessel as a beehive for the following reason. He found in the Justinian fortress several vessels having 1) a name scratched outside, and 2) groups of vertical grooves inside, on one side only, and identified them as beehives. To be sure, the Rachi specimen differs in shape and in fabric from those of the fortress; the beehive of the Rachi is of Corinthian fabric, the

\textsuperscript{11} Perrot-Chipiez III, 881.
\textsuperscript{12} Vit. Alex. 36.
\textsuperscript{13} Pliny, Nat. Hist. 9.127.
\textsuperscript{14} Forbes, Studies in Ancient Technology IV, 140; cf. also RE s.v. Schnecke Καλαίτης Κορυθησκῆς: εἶτα δὲ ἀἱ μὴν πορφυρὰ τοῦτον, αἱ δὲ ἱσαχαῖς, αἱ δὲ δεκατσαύαι: λάβοι δὲ αἱ
\textsuperscript{15} Syria 15 (1934) 141ff.
\textsuperscript{16} Ibid. 141.
\textsuperscript{17} Lorimer, Homer and the Monuments 63 and 397.
\textsuperscript{18} Strabo 16.2.23. \textsuperscript{19} Cf. note 12.
others are not. The Rachi beehive presumably had a lid. The others were closed on top. The scratched name (ΟΡΕΣΤΑΔΔΑ) was probably the name of the owner or of the maker; and may have been used as a trade-mark. The slit served as the entrance for the bees. The grooves inside helped the bees to fix their wax-cells on the walls of the beehive. Several fragments of similar beehives have been found among the movable finds of the Rachi. This type of beehive presents a considerable advantage: if the bees are crowded, more room can be provided through the addition of a bottomless cylindrical stem. The lid in this case would be set on top of this stem.

The Rachi beehive brings us to the story of Kypselos, the tyrant of Corinth: the Delphic oracle once predicted that the son of Labda (who was a Bacchiad but was not married to a Bacchiad) would rule over Corinth. The Bacchiads sent men to kill the baby, but failed, because Labda hid her son in a beehive. It is possible that the beehive in which Kypselos was supposed to have been hidden was thought of as a cylindrical one: something not far removed from the Rachi beehive. That beehives were made of clay is inferred in Aristophanes' Peace (631). Homeric beehives are called κρητήρες and ἀμφιφόριαι (Odys. v 105). These two terms imply the presence of handles. Clearly the form of the Rachi beehive is reproduced on the coins of Kypselas (pl. 81, figs. 3-5). The vessel on these coins has already been recognized by scholars as a beehive. The lower part of the vessel on these coins varies. It may be that Corinthian beehives had a flat bottom and rested on some kind of stand, natural (such as a slab) or artificial. One cannot here go into the details of the form of the larnax of Kypselos: the larnax which was dedicated at Olympia by the Kypselids. According to Pausanias, the Corinthians called the larnakes beehives. Klein suggested that the larnax in Olympia had heraldic significance, was the symbol of the family of the Kypselids, and became the starting point of the legend of this family. P. N. Ure suggested that Kypselos may possibly have adopted a kypsele as his emblem, or may have inherited it from the founder of a potter's factory, and this might have been the immediate origin of his name. Emblems as family badges were widely spread in early Greece.

Among the other movable finds of the Rachi we mention: 1) Bowls with a spout. All sorts of liquids may have been poured from them (pl. 82, fig. 14).

2) Various cooking pots. We have: (a) shallow cooking pots (pl. 82, figs. 9-10). They may be thought of as ancient capsae; evaporation of various solutions may have been obtained from them. (b) deep cooking pots (pl. 82, figs. 11-13) used for various purposes. Some are provided with strainer spouts (pl. 82, fig. 11). In these a liquid was probably prepared (from cooking some organic dye material—for instance, ground oak-apples may have been cooked there, the liquid then strained, the solid bits left inside).

3) Millstones. They were used for grinding various materials used in the process of dyeing.

4) Narrow-necked jugs and juglets. Some of them are of non-Corinthian manufacture. They may have contained certain imported dyes (pl. 81, fig. 7).

5) A large vessel of a very peculiar form (pl. 81, fig. 8). It bears no sign of fire on the bottom and cannot be a cooking pot. It is divided into two compartments: one slightly higher, circular, with flaring rim, and rather small; the other larger, elongated, and with vertical rim. The two compartments communicate through a large opening.

The division into two compartments, one larger than the other, suggests that some sort of liquid passed from the smaller to the larger compartment of this vessel. The flaring rim of the circular compartment, and the opening, point to extraction. The impression one gets from this vessel is that a dye material, or the like, was put into the small circular compartment. Some kind of solvent was then poured on this material. The solvent may have been poured directly, or through a funnel-like container set on the flaring rim (funnels are traditionally used for extraction, and are still in use). The inside of the vessel has a dark thick deposit on the bottom—the remains of the extracted dye? According to the chemical analysis, this deposit consists of 1) organic matter, 2) silica. Silica colloid, found in all earthenware, who wanted to explain a magnificent offering about which they knew nothing.

20 Imhoof-Blumer in AbhBayer 18, pl. 6; cf. also P. N. Ure, The Origin of Tyranny 200.

21 Klein, "Zur Geschichte der Kypseliden," ShAkWien 8 (1884).

22 P. N. Ure, The Origin of Tyranny 208.

23 Furtwängler (Meisterwerke der griechischen Plastik 723-32) thought that the story was devised by the Olympian guides
easily absorbs other liquids, especially dyes. The silica of this deposit might be the silica contained in the clay of the vessel itself. The organic matter might be the real remains of the ancient dye, since ancient dyes were organic. The dark deposit is thicker on the bottom of the small compartment. If the vessel was made for extraction, one would expect to find a thicker deposit on the bottom of the compartment where the dye-material was placed, i.e. in the small compartment.

According to Professor Bronner, the peculiar vessel of the Rachi is probably a baby’s toilet of unique shape. There seems to be something in this view, too. Urine helps to dissolve acid dyes. It was used by ancient dyers as a detergent, and also to get proper dye-hues. Urine mixed with lime provides ammonia. Ammonia is a strong detergent, also a fixative, and in distant parts of Greece urine (of a baby) is still used as a detergent and a fixative.

Some of the “containers,” i.e. the cisterns near the dye-vats, were found full of a material which looked like gray ashes. We have already seen that a similar material was found near the dye-vats at Debir. The ancient dyers probably used fuller’s ashes. According to the ancient sources, natron was used\(^28\) either as fixative or detergent. Scholars have pointed out the false identification of the ancient natron (sodium carbonate \(\text{Na}_2\text{CO}_3\)) with nitre (sodium nitrate \(\text{NaNO}_3\)).\(^27\) Egypt seems to have possessed several centers of sodium carbonate in antiquity, and these centers were monopolized by the state in Ptolemaic times.\(^28\) Whether the Greek dyers employed Egyptian sodium carbonate is doubtful. Sodium carbonate, however, could be obtained from other sources, for instance efflorescences. Sodium carbonate could also be obtained from the combustion of plants. The ashes of these plants contain alkali, and alkali acts both as a degreaser and as a fixative. In one of the “containers” of the Rachi calcined stones were found. Like ashes, lime may have played a role in the process of dyeing. To suggest, however, that ancient lime survived through the centuries in this “container” may be quite misleading.

It is not surprising that dye-works were combined with weaving-works. Ancient sources speak of such instances. The subject will be treated in detail in the final publication of the site.

One naturally thinks of the Rachi works as a temple industry where the sacred garments of the gods and goddesses, as well as those of the priests and priestesses, could be manufactured. The settlement on the Rachi, however, is only partly preserved. The dye- and weaving-works seem to have occupied a much larger area. The lasting impression is that the industry on this hill was on a large scale. It is possible that a guild of dyers was given a lease, perhaps by the sanctuary. We do not know what caused the end of this flourishing industry, and the site seems to have been abandoned rather than destroyed. The few calcined stones found in one “container” cannot be taken as evidence of a violent catastrophe; neither can the presence of ashes (fuller’s ashes). There are several possibilities which may explain the end of the industry: a disagreement between temple officials and the heads of the guild as to rental and other taxes; a decision of the temple officials to beautify the area by removing the dye-works from the hill; a decree monopolizing the dyeing industry in the district; the establishment of a rival center somewhere else in the neighborhood; the introduction of indigo (\(\text{ιδικόν χρώμα}\)) from the East, and the construction of vats built to be heated.\(^29\)

ATHENS

Fig. 1. Another dye-works at Rachi

Fig. 2. Dye-works at Debir
Figs. 3-5. Coins of Kypselia

Fig. 6. The Orestada Vessel

Fig. 7. Narrow-necked jug

Fig. 8. Vessel for extraction?
Figs. 9-10. Ancient capsae?

Figs. 11-13. Deep cooking pots

Fig. 14. Bowl with spout