What Is the Madder with Lydia’s Purple? A Re-Examination of the Purpurarii in Thyatira and Philippi.

David E. Graves, PhD
What is the Madder with Lydia’s Purple?
A Reexamination of the Purpurarii in Thyatira and Philippi

David E. Graves
Assistant professor and SME
Liberty University, Rawlings School of Divinity, Lynchburg, VA

Commentators have repeatedly stated that because Lydia of Thyatira, the seller of purple mentioned in Acts 16, lived so far away from the coast, she must have worked or traded in purple produced from the Madder root rather than the expensive “Tyrian Purple” derived from the murex shellfish. This article challenges this assumption by examining the recent archaeological and epigraphical discoveries which demonstrate that murex dye was used inland, together with laboratory tests that shed new light on the nature of the purple dyeing process. Lydia would have either employed or purchased textiles, dyed from both madder root and murex shellfish, to meet the demand for a wide price range and quality of product from her clients.

Keywords: madder root, purple dye, murex shellfish, Lydia, Thyatira, Philippi

Introduction

Anyone familiar with Acts 16 will recognize the reference to Lydia, one of Paul’s first converts in Asia, who was a seller of purple (πορφυρόπωλις, Lat. purpurarius) in Philippi, who had originated from Thyatira (Acts 16:14–15, 40). The Roman provinces of Lydia and Phrygia (Broughton 1975, 4:818n1, 819), were famous for their clothing industry (i.e., dyeing, wool production and tapestry; Homer, II. 4.141–42; Claudian, Rap. Pros. 1.269–71; Flaccus, Argonautica 4.367–70) and essential to this was the dyeing process, documented from the Bronze Age to the Byzantine period, and the prominent role that the first century AD dyers guild played in city associations (Magie 1975, 1:48; 2:812n80; Harland 2011, 121–29). However, the term purpurarius and the dyeing process are problematic.

Traditionally scholars have claimed that the textiles sold by purpurarius, such as Lydia, were made from the famous and expensive “Tyrian Purple” derived from several varieties of the murex shellfish (see figs. 1, 2 and 5). More recent commentators, led by William Ramsay (1994, 238–39) and Colin Hemer (1975, 114; 2001, 109), based on the research of French scholar, Michel Clerc, have challenged this view (1893, 93). It is represented by Ramsay’s claim that the dyeing in Thyatira was performed in ancient times with madder-root, [rubia peregrina L. that also grew in the region of western Anatolia and used today in the region to dye carpets]. . . , [and that] the purple stuffs which the Thyatiran Lydia sold in Philippi (Ac 1614) was dyed with what is, in modern times, called “Turkey red.” (1909, 4:759)

Hemer (2001, 109) also pointed to Strabo, who testified that the water at Hierapolis is remarkably adapted also to the dyeing of wool, so that wool dyed with the roots [madder roots] rivals that dyed with the coccus [Ker-

Figure 1. Bronze coin of Tyre. Upper portion, a tree growing between rocks; lower portion, depiction of the legend of Hercules’ dog discovering the purpura murex shellfish; reverse (not shown), portrait of the Emperor Gallienus (AD 253–268). Public Domain.
Table 1. Members of the dyers guild (βαφεῖς) in Thyatira.

<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation</th>
<th>Association</th>
<th>Date AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiochosa</td>
<td>…</td>
<td>First dyer as a benefactor to the city</td>
<td>. . .</td>
</tr>
<tr>
<td>Claudia Ammionb</td>
<td>Civic high-priestess and imperial cult priestess</td>
<td>Director of contests</td>
<td>ca. 50</td>
</tr>
<tr>
<td>T. Claudius Sokratesc</td>
<td>Provincial imperial cult high-priest Pergamum</td>
<td>…</td>
<td>ca. 100</td>
</tr>
<tr>
<td>T. Claudius Sokrates Sakerdotianos</td>
<td>Civic imperial high priest, prytanis, crown bearer</td>
<td>. . .</td>
<td>ca. 120</td>
</tr>
<tr>
<td>Makedonos</td>
<td>Civic police chief</td>
<td>Market overseer</td>
<td>. .</td>
</tr>
<tr>
<td>M. Julius Dionysios Akylianos</td>
<td>Civic crown bearer</td>
<td>. .</td>
<td>ca. 120</td>
</tr>
<tr>
<td>T. Antonius Claudius Alfenus Argnotus</td>
<td>Equestrian military commander and procurator</td>
<td>Temple warden imperial cult and priest of Apollo</td>
<td>199–200</td>
</tr>
<tr>
<td>Aurelius Artemagoras</td>
<td>Member of the civic board of ten</td>
<td>. .</td>
<td>2nd–3rd cent.</td>
</tr>
<tr>
<td>Marcus, son of Menandros</td>
<td>Superintendent of the dyers</td>
<td>Market overseer and secretary of the people</td>
<td>2nd–3rd cent.</td>
</tr>
</tbody>
</table>

a Kalaitzaki et al. 2017, 109; Benda-Weber 2013, 185; Pilhofer 2009, §2.697/M580. This inscription (697/M580) was found in Philippi in 1872.

b Herrmann 1989, §5.972.

c Herrmann, §§935, 945, 965, 972, 978, 980, 989, 991, 1029, 1081; Arnaoutoglou 2016, 282; see table 1).

d Herrmann, §5.980.

e Herrmann, §§5.965, 5.991.

Koren explains, “The dye molecules must penetrate the interiors of the fibers” (2005, 139) and the quality of the supply of water is so abundant that the city is full of natural baths. (Geogr. 13.4.14 [Jones])

The argument is also made that the “Tyrian Purple” dye could not have been used at Thyatira, because of the assumption that the dyeing facilities must have been housed on the coast (Pliny, Nat. Hist. 35.26.45) to take advantage of the marine supply of murex shellfish (Barber 1991, 228–29). This article challenges this assertion by examining the recent archaeological and epigraphical discoveries, together with laboratory tests that have shed new light on the nature of the purple dyeing process and provided more clarity to the nature of the purpurarius that Lydia was involved.

First, Roman purple varied in intensity, encompassing shades of pink, red, rose and scarlet referred to in the ancient ideology as red-purple (Summer and D’Amato 2009, 217), but in Pliny’s opinion, the best purple was the color of congealed blood that is “blackish at first glance but gleaming when held up to the light” (Nat. Hist. 9.62.135 [Rackham]). Second, it must be acknowledged that the dyeing process has been studied, and found to be somewhat of an enigma.

**Dyers Guild in Thyatira**

**Members of the Dyers Guild in Thyatira**

We know that Thyatira was heavily involved in the purple dye industry from several inscriptions mentioning important city officials who were connected with the dyeing guild (Herrmann 1989, §§935, 945, 965, 972, 978, 980, 989, 991, 1029, 1081; Arnaoutoglou 2016, 282; see table 1). Fifteen of the 28 inscriptions are related to the trade of purple-dyers (πορφυροβαφεῖα; Ritti 1995, 71–72), although no inscriptions from Thyatira mention πορφυροβαφεῖα, “purple dyers,” but only βαφεῖς “dyers” (Ruscillo 2005, 100). More than half of the inscriptions (32/53) from Thyatira and the area of Saittai pertain to the textile industry (Arnaoutoglou 2016, 282). Table 1 provides a selection of the more important inscriptions mentioning the individuals involved in the dyers guild from Thyatira and their occupation, association and date. Reimer rightly notes that Thyatira was known for more than purple goods (purpurarit), and likely produced a wide range of dyed products (1995, 99–100) in a variety of colors.
Lydia lived in Philippi as a πορφυρόπωλις, widely translated as a seller of purple (πορφύρα, Lat. purpurarius/a) cloth, but probably learned her textile business (Lafaye 1901, §4.1252; Böeckh 1877, §§3496–98 [λαναριοι, Lat. lanarii carminatores, dyers]) in Thyatira (Magie 1975, 1:47–48; 2:812n79; Keener 2014a, 3:2399–407), which contributed greatly to the city’s prosperity. Menippus of Thyatira, was also of the collegia of purple-dyers (πορφυροβάφ), and sold purple goods in Thessalonica (Edson 1972, §291; Istanbul Museum cat. no. 271; Hemer 2001, 109).15

Hierapolis, just 90 miles (150 km) southeast from Thyatira, also has numerous inscriptions that referred to guilds. Of the 25 references to guilds, the majority were associated with textiles: 7 to πορφυραβάφοι (purple-dyers), 3 to βαφεῖς (dyers), ἐριοπλύται (wool washers), 1 to ἀκαιροδαπισταί (carpet weavers), and λινωταί (linen weavers?; Ritti 2004, 486–87; Arnaoutoglou 2016, 281–82). In one inscription found at Hierapolis (Frey 1952, §2.36) there is mention of M. Aurelius Alexander Moschianus from Hierapolis, who was a πορφυρόπωλς, “purple-seller” and “town councillor” (Pleket 1983, 141). Πορφυρόπωλης is a masculine form of the term used by Lydia. Peterlin points out several implications of this inscription. He states,

The πορφυρα-terminology came to be used for clothes dyed with any dye within the range of purple color, not just dye produced with molluscs. Furthermore, this purple dealer most probably was not a mere dye-maker or dyer who had become rich by selling his own products, but conceivably a wealthy landowner who became rich through the wool and cloth trade. He may have employed his own dye-makers and dyers. It is also possible that as a better-to-do seller he employed his own sales-representative and shippers. (1995, 156)

Although there is a lot of speculation in this paragraph, it is likely also that the same can be said of Lydia. However, must the term πορφυρόπωλης exclude the use of dyes produced by mollusces? This will be examined later in this article.

A fragmentary Latin inscription recovered from Philippi appears to refer to “purple dealers” (Mommsen 1974, §3.664.1; purpurarius or i). It is known that women were involved in the purple dye trade from a Greek inscription where the term “purple dealers” (πορφυρόπωλης) appears in the feminine form (Böeckh 1877, §2519; see also Homer, II. 4.141; Barrett 2004, 2:782). It appears that Lydia was not alone in Philippi carrying out here trade as Antiochos from Philippi was the first dyer to be a benefactor to the city of Thyatira (Pilhofer 2009, §2.697/M580; Benda-Weber 2013, 185). There was a close connection with the dyeing trade of Philippi and Thyatira.

Ascough’s assumption for his investigation of Lydia is that “Luke is portraying Lydia as a woman of means who owns her own house” (2009, 32), the view held by most commentators. Schille is one of the few who claims that “it is not evident that Lydia was wealthy” (1984, 341). Lydia’s wealth hinges, in part, on the costly products, such as the murex shellfish, used in the dyeing process (see figs. 1, 2 and 5). What evidence is there for this murex trade?

History of Tyrian Purple Dyeing

Porphyrology16 has a long history, with much written (Spanier, Karmon, and Linder 1982, 437–47) on the production of purple dye in ancient times (Heinisch 1957, 203–6; Jensen 1963, 104–18) and it is not the intention to repeat it here. There is debate over the Minoan origin of Tyrian Purple (Stieglitz 1994, 46–54) and whether it originated with the Phoenicians (Strabo, Geogr. 16.2.23; Astour 1965, 346–50). Koren claims that while the Minoans may have originated the process, Phoenicians perfected the craft (1995, 118). However, the debate is irrelevant to our research here and will not be examined further.

The archaeological indicators of the purple-dye industry include purple stained containers, crushed murex shells in large quantities or in occupational strata, burnt organic matter, and various equipment such as vats, cisterns, crushing and perforating tools (Alberti 2008, 75–76). There may also be weaving instruments such as loom
weights and spinning apparatus nearby. The archaeological and literary evidence indicate that the most prestigious purple dye, “Tyrain Purple,” was derived from the mollusk shellfish (see figs. 1, 2 and 5) which flourished along the Mediterranean coast. Pliny highlights dye facilities along the coastal regions (Nat. Hist. 35.26.45) of Greece (see table 2), Crete, Italy, Syria, North Africa, and Morocco (Pliny, Nat. Hist. 6.201–3; Anderson-Stojanovic 1994, 309–10). Archaeological sites of Mollusk shellfish dye facilities have also been identified in Lebanon, Israel, Cyprus, Egypt, Turkey, Spain, France (Reese 1980, 82), Qatar (Edens 1999, 71–88), and Mesopotamia (Levey 1959, 108–11; Koren 1995, 119; see fig. 3). This is certainly not an exhaustive list, however it does indicate that purple dye was produced in specialized workshops (Lat. tinctoria) along the coastal areas of the western Mediterranean, where the murex shellfish flourished and then sold locally to craftsmen. Several of the sites are inland from the coast. During the Temple Mount Sifting Project in Jerusalem some 20 murex trunculus shells were recovered from sifting. Jerusalem is 32 miles (52 km) from the coast. Scholars wonder if there was a dye facility in Jerusalem dying the tassels for the prayer shawls (“Aren’t You Dying To Know?” 2017, n.p.). Other inland dye facilities are listed in table 2.

**Pigments and Dyes**

Koren points out that there is a distinction that needs to be observed when talking about dyes. The terms “dyes” and “pigment” are two separate things. As Koren explains,
Table 3. Terminology for purple, blue, and red dye.

<table>
<thead>
<tr>
<th>Dye (Color)</th>
<th>Prepared from</th>
<th>Sumerian</th>
<th>Akkadian</th>
<th>Hebrew</th>
<th>Greek</th>
<th>Latin</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyrian purple</td>
<td><em>Murex trunculus</em>, <em>Murex brandaris</em>, <em>Buccinum lapillus</em>, <em>Helix ianthina</em></td>
<td>SIG-ZA-GÍN-DIR, SIG-ZA-GÍN</td>
<td>argamanu, tākītu</td>
<td>argāmān, tekhelet</td>
<td>porphyra, hyakinthos</td>
<td>purpura</td>
<td>Syr. argewānā, tekelta</td>
</tr>
<tr>
<td>Woad Blue</td>
<td><em>Isatis Tinctoria L.</em></td>
<td>uqnātu</td>
<td>isātis (kyaneos)</td>
<td></td>
<td>glastum, vitrum</td>
<td></td>
<td>Aram. izlim</td>
</tr>
<tr>
<td>Indigo Blue</td>
<td><em>Indigo argentea</em>, <em>Indigofera coerula</em></td>
<td>. . .</td>
<td>indīkon chroma</td>
<td></td>
<td>caeruleum indicum, indicum acanthus</td>
<td></td>
<td>Arab. indik, nil</td>
</tr>
<tr>
<td>Cochineal Red</td>
<td><em>Coccus cacti</em> breeding on <em>Aeluropus leavis</em> or <em>Dactylis litoralis</em></td>
<td>. . .</td>
<td>šinātu (?)</td>
<td>karmīl</td>
<td>kokkīnos, kokkos</td>
<td>coccus</td>
<td>Arab. ṣahr</td>
</tr>
<tr>
<td>Kermes Red</td>
<td><em>Kermococcus vermilio</em> breeding on <em>Quercus coccifera L.</em></td>
<td>. . .</td>
<td>tabarru</td>
<td>. . .</td>
<td>baphike</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Madder (alizarin) Red</td>
<td>Root of <em>Rubia tinctorium</em></td>
<td>²LAL (?)</td>
<td>. . .</td>
<td>fāʾā</td>
<td>crythro-danon</td>
<td>rubia, varancia</td>
<td>Arab. fiswwa</td>
</tr>
</tbody>
</table>

While they can be both generically referred to as “colorants”, a “pigment” is a substance that is essentially insoluble in water, whereas a “dye” is water-soluble. In order to perform a true dyeing of a textile – and not just to paint its surface – the colorant must be dissolved in an aqueous solution so that the individual dye molecules can penetrate into the interior of the textile fibers and then form strong physico-chemical bonds with the fibers. In this way, the dye will be fast, i.e., will be stable and will not wash out of the textile when laundered. When the colorant is a pigment, it cannot be used in dyeing unless it is converted to a soluble form, and then that pigment becomes a dye. For example, in the current study, indigo and its brominated derivatives that constitute the molluskan purple pigment, if they were to be used as true dyes, must be solubilized by reducing them to their soluble reduced leuco-form [lacking color], as mentioned above, and in that state they function as “dyes” for the dyeing of textiles. On the other hand, if a pigment is left as such in its water-insoluble state without further processing, it cannot be used for the dyeing of textiles – an internal phenomenon – but only in the painting of objects – an external, surface treatment. (2013, 62–63)

Table 3 shows the terminology of the purple, blue, and red dye, adapted in part from Forbes (1993, 103, 111).

The Process of Dyeing

Preparation for Dyeing

Once the fleece (Lat. *lana sucida*) had been sheared from the sheep, it was submitted to a preliminary scouring (Lat. *putara*) to remove the impurities, grease, burrs, and lanolin (Varro, *Res. Rus.* 2.2.18; 2.11.6–9; Wild 1970, 23). This was carried out at the *fullonica* where the wool was cleaned (Mommsen 1974, §14.4573; Meiggs 1973, 312; see fig. 4). The *fullonica* acted as both the finishers of loom-state (*de tela*) cloth and as the clothes cleaner. The occupation of the fuller was reserved for the wealthy who would employ a large staff. As Wild points out, the plant and tools of the trade [of the fuller] were expensive to build, buy and maintain; and the series of special operations which took place in the fullery could hardly have been carried out by one man [or woman]. Only the wealthy could afford to run a private *fullonica*, so that most of the cloth which was woven at home or bought had to pass through the professional fuller’s establishment. (1970, 82)
The next process was to dye the wool at a tintoria (dyeing or tinting) prior to spinning (i.e., “dyed in the wool”). Fullonica and tintoria have been discovered across the street from each other and excavated at the colonia of Barcino (modern Barcelona), Spain (Beltrán de Heredia Bercero 2000, 253–59). Wool spun at home (Mommsen 1974, §1.2, 1211, “she kept house, she made wool,” Cicero, Verr. 4.59), as was performed in antiquity at Ephesus (Trinkl 2007, 81–86), could not be dyed at home (Wild 1970, 23, 80), evident from individual colored yarns of a tartan pattern that logically had to be dyed before weaving and had to be brought to a fullonica/tintoria to be processed (Pietrogrande and Becatti 1976). Keener points out that “most textiles were produced in homes, but more-precious ones could be produced in factories and exported” (2013, 2:2396).

Dyes Used

There was various animal (shellfish and insects) and organic dyes (various plants) used to produce a rainbow of colors in antiquity. Among them were the murex shellfish species, madder (ςροθρόδανον), cochineal (κόκκος), sea-weed (φόκος), woad (ισατις), saffron (κρόκος), black oak-apple (κηκίς), and other organic dyes (Sebesta 2001, 69; Cooksey and Sinclair 2005, 127–35).

Madder Root Dye

Cannon reports that “madder [the best quality is called crap, krappe or crop] is native to western and central Asia and doubtfully so in the eastern Mediterranean. It has become naturalized in many areas of central and southern Europe” (2003, 76). A precious blue-purple wool (Assyr. takiltu) was known to the Hittites/Assyrians in Asia Minor (Reiner 2006, 70–73), although these were likely traded commodities (Matoian and Vita 2014, 310–39). Madder (Assyr. hurrutu) and alum (Assyr. abnagabiu), used as a mordant, are often found together in Middle Assyrian textiles (Postgate 2014, 410–11).

The wild madder plant was used to create purple and violet hues without the use of a murex dye. Purple dye is derived from the central part of the madder root, dried, and ground into a powder. Dyeing is a slow process whereby premordanted wool is mixed with chalk or slaked lime and slowly heated to exactly 85 degrees Celsius (185 degrees Fahrenheit), otherwise the colors become dull and brown (Cannon 2003, 76).

Over 300 wool textiles and basket fragments have been recovered from sites along the spice route joining Petra and Gaza. Koren and Shamir analyzed several samples of fabric decorated with dyed bands of various hues of purple and found evidence that the yarn, rather than the woven cloth, was dyed with kermes, madder, and indigotin (Koren 1999, 129–36; Shamir 2004, 49–52).

There seems little doubt that madder root was used as a dye at dyeing facilities in Anatolia in the first century, however the question is, was it the only dye available and used? This will be addressed below.

Tests carried out by Koren have identified the presence of madder root in textiles dyed purple from the Nabatean region, Masada, and the Cave of Letters in Israel (1994a; 1997; 1999, 132; Koren and Verheeken-Lammens 2013). However, it was determined that just using madder root “yielded more alizarin (orange) than purpurin (purple)” (Koren 1999, 132). To produce the purple hues that imitated the Tyrian purple textiles required a double dyeing of red madder root (wild or regular) and blue indigotin obtained from the leaves of two plants, woad (Isatsis tinctoria L.; derived from the Middle East; Koren 1996, 296–310) or indigo (Indigofera tinctoria; derived from India; Koren 1993, 25–33). Pliny indicated that the vibrant Tyrian purple “double dyed” (Lat. dibapha) was also derived from Marine shellfish (Pliny, Nat. Hist. 9.137), likely the murex pelagium and murex bucimum.
Murex Shellfish Dye

The expensive Tyrian (Lat. Purpura Tyria; or Phoenician; Ovid, Metam. 6.8–9; Vitruvius, Arch. 7.13; Pliny, Nat. Hist. 9.61) “true” or “pure” purple textile dye was first used by the ancient Phoenicians (1570 BC; McGovern and Michel 1985, 1514–22). The approximately 3600-year-old ancient biochemical process for producing the murex dye (Ziderman 1986b, 187–98) is described by Aristotle (Hist. An. 4.1–5, 8, 11; 5.15; fourth century BC), Pliny (Nat. Hist. 5.19; 6.201; 9.60–64; 14.12; 26.20; 35.44–45; first century AD) and the Talmud (Menahot 42b; fourth century AD), and has been scientifically replicated in the modern laboratory with various degrees of success, until Koren’s triumph (2005, 136–49). The relatively simple process was complicated due to various factors; including PH, illumination (Pollux, On. 1.45–49), salinity, temperature (Aristotle, On Colours, 32–33 [797 a]), humidity, and washing (McGovern and Michel 1990, 154; Koren 1995, 123). The dye was produced from the very small hypobranchial gland of sea snails of the family Muricidae, commonly called murex mollusks (Koren 2005, 136; see figs. 1, 2 and 5), that is either secreted or extracted from the gland while it is alive or crushed in a vat (Pliny, Nat. Hist. 9.61; Ngangbam et al. 2015, 443–54). Only a small drop of fluid is produced by each snail and only turns to purple when exposed to the air (Doumet 1980). The most cost-effective way to harvest large amounts of murex dye is by crushing and thus, many crushed shells became the archaeological indicator of a dye facility, unless at a household level (Becker 1996, 3–17), since the murex can also be eaten for food and used as fish bait (Çakır and Becks 2009, 89). The murex dye is identified as 6,6′-dibromoidigo (McGovern, Lazar, and Michel 1992b, 145–50; Cooksey 2001, 736–69), differing from indigo only by the bromine (Barash and Danin 1992, 119–30). These species include Hexaplex trunculus (also, Murex trunculus, Phyllonotus trunculus, Trunculariopsis trunculus); Bolinus brandaris (also, Murex brandaris) and Stramonita haemastoma (also, Thais haemastoma, and Purpura haemastoma; Radwin and D’Attilio 1976, 93; Doumet 1980).

The reddish liquid dye called ostrum, frequently called ostrinum, ostro, ostrum rubens, ostrum sanguineum, or ostrum puniceum, was produced from crushing the Murex conchylium (Marcellus, Comp. Doct. 2.4.M549; Sebesta and Bonfante 2001, 75n48) in a mortar and mixing it with honey to preserve it for export/transport (Vitruvius, Arch. 7.13.1–3). Although Vitruvius is likely only talking about “pigments” for architecture, i.e., painting surfaces of buildings, walls, etc., and not as a textile dye, both pigment and dye were produced from the same murex species. It was used as a dye for clothes (Varro, Res. Rus. 133.9; see textiles below), bed covers (Propertius, Eleg. 1.14.20), the clavi on napkins (Lat. mappa; Martial, Epig. 4.46.17), and tablecloths (Lat. toralis; Marcellinus, Hist. 16.8.8).
Tests carried out on a piece of cloth from Masada verified that it was dyed from the murex shellfish, but no dyeing facility was discovered there (Koren 1994a, 257–64). Koren argued that they were likely from the royal cloak or mantle of Herod the Great, since the more expensive purple murex dye was used (1997, 23).

Pliny in his treatment of wool production identified the use of both animal dye (marine shellfish) and plant dyes (Nat. Hist. 8.187–99).

This [Tyrian purple] was first used in a bordered robe by Publius Lentulus Spinther, curule aedile, but met with disapproval, though who does not use this purple for covering dining-couches now-a-days? Spinther was aedile in the consulship of Cicero, 63 B.C. Stuff dipped twice over used at that time to be termed ‘double-dyed’ [Lat. dibapha], and was regarded as a lavish extravagance, but now almost all the more agreeable purple stuffs are dyed in this way . . . The prices for dyestuff vary in cheapness with the productivity of the coasts [marine shellfish production], but those who buy them at an enormous price should know that deep-sea purple nowhere exceeds 50 sesterces and trumpet-shell 100 sesterces per 100 lbs. (Nat. Hist. 9.137, 139 [Rackham])

Pliny indicates that the use of Purple murex dye in the “double dyed” process, once regarded as a “lavish extravagance,” was both affordable and common in his day (AD 23–79).

Mordants

While murex purple was a colorfast dye on its own, through fermentation and oxidation, vegetable dyes like madder root required some binding agent (mordant meaning “biting in”) to set the dye permanently in a fabric (Barber 1991, 235). The mordants fall into two categories acids and bases and were either alum, vinegar, tannic acid, ammonia, or common salt (Rice 1963, 57–58). These additional developers were used during or after the dyeing process to help enhance the color and fix the dye to the cloth. Barber explains that “wool that has been dyed in madder with alum mordant turns a richer, deeper red when dunked in ammonia water [animal urine] as it comes out of the dye bath” (1991, 236). The binding of the madder dye to wool and especially linen was not an easy process and certainly more complicated than the murex dye.

Bad Odors

The foul odor from the shellfish is well attested in both antiquity (Strabo, Nat. Hist. 16.2.23), modern experiments (Ruscillo 2005, 105), and by various scholars (Forbes 1993, 4:119; Bartosiewicz 2003, 175–95). Ruscillo observed that “a persistent problem throughout these extracting, concocting and dyeing experiments was the deep pungent smell of Murex” (2005, 105). Ruscillo reports that even after washing the textiles the odor remained and so perfume was most likely necessary for new garments (2005, 105). The odor of the production facility would likely dictate the location of the facility away from residential areas. However, the dye site at Tel Dor, Israel, was in the residential area (Bartosiewicz 2003, 183). Bartosiewicz could only conclude that “money had no smell” (2003, 183). As Karmon and Spanier observed most of the dyeing facilities were located on the eastern edge of sites, since for most of the year the prevailing winds were from the westerly direction (1987, 149).

The Supply of Purple Dye

Pliny explains that the process of murex dye preparation required nine days of fermentation accomplished through alkalinity and heating to prepare the liquid for dyeing (Nat. Hist. 9.62.133). However, Lowe explains that within minutes of the murex shell being broken the “dye oxidises to form a pigment that is insoluble in water and thus unsuitable for dyeing” (2004, 46). As Ruscillo explains from her experiments that “it is important to keep the specimens alive until the dye is ready to be extracted because after death, little or no mucus can be extracted from the dry Murex” (2005, 103). The traditional solution is to locate the dye facilities (Lat. tinctoria) near the coast (Barber 1991, 228–29; Kalaitzaki et al. 2017, 108–9.), so the fabric can be immediately dyed before oxidation (Edmondson 1987, 120).

Another solution is documented that preserves the dye through oxidation using urine, lime or wood ash to achieve an alkalinity of 9 pH (Edmonds 2000, 26; Koren 2013, 54–58). According to Lowe “dissolving the dye in an alkaline solution allowed transportation in the form of an insoluble pigment to be dissolved at the point of destination” (2004, 47). This is confirmed by a vessel from the hill of “El Molinete” in Carthago Nova, Spain which contained an early Roman jar with 3 kg of crushed shells including murex trunculus, murex thais, and murex brandaris (Reese 1980, 86). Lowe explains that after the
dye was transported to a new location the “oxidised pigment in turn could be dissolved by re-immersion in alkaline water” (2004, 46) allowing the pigment to be exported (Reese 1980, 86; Lowe 2004, 46–48).

**Barcino, Spain**

Beltrán de Heredia Bercero documents both a second century AD *fullonica* and *tinctoria* (dyeing or tinting) across the street from each other, in excavations northeast of the *colonia* of Barcino (modern Barcelona), Spain with sediments of urine, lime and ash used to fix the dye for transport found in the vats lined with tiles (Lat. *opus signinum*; 2000, 253–59).

Dyeing was not necessarily a coastal venture as the dye was traded in pigment form and shipped overland to sites away from the coast (Lowe 2004, 46–48). The Ephesian customs-law documents a “5% import tax on purple shells being imported into Asia Minor” (Pleket 1998, 123). And if live murex were transported the numbers needed could easily be accommodated by the transport jars. In addition, Thyatira was strategically located on the border with Lydia and Mysia, and ideally situated for trade (Strabo, *Geogr.* 13.4.4).

In addition, several examples of murex dyeing facilities have been excavated inland. Following are a few examples.

**Tell Rifa’at, Syria**

In the early 1960s at the site of Tell Rifa’at, Syria, a Hellenistic courtyard was excavated and 77 spindle-whorls and 21 loom-weights [quadrilateral], along with several large stone vats used for dyeing, were discovered (Seton-Williams 1961, 77). In addition, Seton-Williams reported that “outside these houses there was a large bank of crushed shells, over 22 m. thick, which have now been identified [by H. E. J. Biggs] as *Murex trunculus*. This is the first evidence we have that the industry of weaving and dyeing purple woollen goods was carried on far inland” (Seton-Williams 1967, 18). Tell Rifa’at is over 60 miles (97 km) from the Mediterranean coast. Reese states that “The date and distance from the sea suggests that they may more likely be interpreted as food “trade” goods or ornaments” (Reese 1980, 85). However, the weaving instruments and large dye vats indicate otherwise. Even if the purpose was for food the large deposit of *Murex trunculus* had been transported overland and crushed inland.

**Isthmia, Greece**

Another site in the Argolid peninsula in Greece is the Rachi settlement at Isthmia, that had an excavated workshop. Although there has been some debate over the identification of the workshop from a dyeing facility to facility for wine or olive oil production (Drachmann 1932, 86; Broner 1958, 19; Hadjisavvas 1992, 25), Anderson-Stojanovic admits that after visiting the dyeing facility in Morocco that the facility at the Rachi settlement was most likely used for dyeing (Anderson-Stojanovic 1994, 309–10). She reports that in the 1989 excavation, 78 loom weights were recovered from various houses (Anderson-Stojanovic 1996, 87, 90) that would support the earlier theory, held by others, that it was a dyeing facility (White 1984, 40, fig. 32; Barber 1991, 241; Foxhall 1993, 186–87). Anderson–Stojanovic concludes, “given the shape of the vats and tanks, and the location of the settlement, fulling and tanning of animal products may also have been practiced” (Anderson-Stojanovic 1994, 310).

If the dye-works of Isthmia are recognized not only as ordinary dye-works (βαφεῖα, *bapheia*), but also as purple dye-works (πορφυροβαφεῖα; Plutarch, *Vit. Alex.* 36.1–2), the question naturally arises why the Rachi installations at Isthmia was chosen for this industry since it was 328 feet (100 meters) above sea level, high on a hill (Kardara 1961, 263). The murex shells had to be transported a mile (1.6 km) inland and 328 feet (100 meters) uphill to the processing facility. Plutarch records that Hermione in the Argolid [Greece] exported purple dye as far away as Persia. He reports, On making himself master of Susa [Persia], Alexander came into possession of forty thousand talents of coined money in the palace, and of untold furniture and wealth besides. Among this they say was found five thousand talents’ weight of purple from Hermione [Argolid, Greece], which, although it had been stored there for a hundred and ninety years, still kept its colours fresh and lively. The reason for this, they say, is that honey was used in the purple dyes, and white olive oil in the white dyes; for these substances, after the like space of time, are seen to have a brilliancy that is pure and lustrous. (*Vit. Alex.* 36.1–2 [Perin])

**Tel Kabri, Israel**

Tel Kabri, in the north of Israel, is 3.7 miles (6 km) from the coast. Koren has been able to demonstrate that the
modern purple residue produced from the *Murex trunculus* corresponds to the “interior of a basin shard (no. 3438/3)” from ancient Tel Kabri that dates to seventh century BC (1995, 119; Zollinger 2003, 260–62). The mollusc muck was transported from the coast to their fortified site to protect their precious cargo for dyeing in their facility (Kempinski and Niemeier 1994, 40, 52).

**Tel Beit Mirsim, Israel**

Tel Beit Mirsim is 29 miles (45 km) east of the Mediterranean Sea. Loom weights and six or seven dye-plants with cylindrical stone vats (ca. 700 BC) used for purple dyeing (Cardon 1998, 57) were excavated at Tel Beit Mirsim in Israel (Albright 1941, 56; Iluz 2013, 562). Albright speculated that because there were 24 dye-plants and the town was so small, they “must have specialized in the manufacture of textile good” (1941, 56). Murex dyes had to be transported a considerable distance from the coast inland to be used by this major dye centre.

In light of his research, Koren concluded that the murex dye was not identified in textiles in Israel, apart from Masada, but with no dyeing facility (1994a, 257–64), even though Israeli dye facilities have been located on the coast. His conclusion was that “these expensive dyeings were mostly intended for export and not for the local market” (1995, 121).

**Alatsomouri-Pefka, Crete**

A purple dye workshop that used murex shells (*Hexaplex trunculus*) was excavated at Alatsomouri-Pefka (during Middle Minoan IIB, ca. 1800–1700 BC) near the northeastern coast of Crete. Brogan et al. identified it as “established in the countryside well away from any settlement” (2012, 189; Koh et al. 2016, 536). Since it was not near any village or town, the industry had to export its dyes and textiles. The same can be argued for the purple dyeing workshops excavated on Chryssi off the coast of Crete (Apostolakou, Brogan, and Betancourt 2012a, 179–82; 2012b, 189).

Given the documented examples of dyeing facilities inland, noted above, and especially the discovery of *Murex trunculus* at Tell Rifa’at, 60 miles (97 km) from the Mediterranean coast, which demonstrates that murex shellfish were transported inland for dyeing, there is no need to assume that just because Thyatira was inland (42 miles [67 km]) that it could not have used murex in its dyeing process. Koren acknowledged that scientifically “the pigment and muck that it’s [snail’s glandular flesh] attached to could have been similarly transported away from the coast in order to place that ‘stinky stuff’ in a large vat for an ‘industrial’-sized dyeing. The dyeing process included adding water, the right pH, temperature, etc. at the dyeing installation” (email message to author, June 9, 2016).

The evidence of no murex shells at Thyatira, does not mean that shellfish were not employed in the process. This is “the fallacy of negative proof,” which Fischer explains as “an attempt to sustain a factual proposition merely by negative evidence” (1970, 47). As Merling explained: “data not collected or not found constitute non-evidence [fallacious evidence], an argument from silence which does not have the same weight as data that are found” (2001, 64–65). The inscriptive evidence does not specify the products used in Thyatira’s dyeing process.

**Amount of Product Needed for Dyeing**

The argument that thousands of *Murex trunculus* were needed to produce an adequate amount of purple to dye the trim of a garment, requiring it to be close to the source (Hughes 2007, 88), has been proven false by laboratory and archaeological evidence. Ruscillo, in her experiments, noted that while wool dyeing required more shellfish than linen “in general, hundreds often would suffice to produce a fine colour on lighter [wool] garments” (2005, 105) and the use of *Murex brandaris*, would require 50 percent less than of the *Murex trunculus* species (Fouquet and Bielig 1971, 816–17; Koren 2013, 44). The transport of quantities of murex species, suitable for dye facilities inland, is both reasonable and archaeologically demonstrated in 3 kg of various crushed murex shells in an early Roman jar on a vessel from Carthago Nova (Reese 1980, 86).

**Arguments for a Diverse Product Line**

The diversity of textiles sold in the Anatolian province of Lydia ranged from inexpensive garments, to luxurious textiles such as curtains, tapestries and vestments, that were interwoven with gold thread, a process developed in Pergamum (Dittenberger et al. 1915, §3.1018). For the wool trade, Anatolia craftsmen and women would purchase their wool from centers like Miletus and have it dyed purple to be sold locally (Broughton 1975, 4:818). As Pleket explains,

The wool and linen were primarily the concern of the owners of estates and flocks. They were the people
who derived profit from the wool trade by selling to small traders either directly or through their own agents. Purple, however, is a very expensive “industrial” product . . . requiring considerable capital outlay and bringing in attractive profits in view of the high prices paid for finished garments . . . Wool and linen were fed into the textile production process in the area in which the wool was produced. It was the flock-owners who dominated the scene and . . . made the crucial profits . . . The value added in the various stages of production is comparatively small. (1983, 142–43)

To Pleket’s knowledge, there was only one surviving inscription that mentions a M. Aurelius Alexander Moschianus from Hierapolis, who was a “purple-seller” and “town councillor.” Pleket states that “he was presumably a merchant not only in purple dye but also in purple wool and cloth” (1983, 141).

The purple dyers guilds were operated by an executive council (Lat. proedria; Hierapolis, ἑργατηγοί; Thyatira, ἐπιστάται; Böeckh 1877, §3926; Ramsay 1895, 1:106). Broughton further explains the organization of the woollen industry in Lydia:

In the guilds both of Hierapolis and elsewhere it is worth noting that, while there were wool washers, wool workers, fullers and dyers—that is, skilled workmen to prepare the wool for spinning and to treat the cloth afterward,—spinners do not appear at all and weavers only for fabrics of special difficulty such as tapestries or the one-piece garments (ἀπλουργοί). It seems probable that, as in England before the industrial age, spinning and weaving were home activities, occupying the time of women and slaves of the various households. The prepared wool was brought in and the woven cloth taken to the skilled workmen for finishing. Finally, notice should be taken of the emporium at Laodiceia, in which the fullers, dyers (?), and makers of one-piece garments were all concerned: could it have been a central market, a sort of Laodiceian Cloth Hall? (1975, 4:821; Lafaye 1901, §4.863)

**Various Sources for Dyes**

Where did a purpurarius/a obtain the purple for dyeing and pigments? The literary and archaeological evidence indicates that the purpurarius produced their murex purple locally or obtained it in a processed form from neighboring communities or countries, such as Greece, North Africa and Italy (Pliny, Nat. Hist. 35.26.45), that required expert skill and labour (Daniels et al. 1989, 61). Hughes indicates that “one could then technically produce both purple pigment and dye in the same workshop” (2007, 88).

### The Use of New Shades of Purple Dye

Due to purple being the status color of Roman royalty and the preoccupation with rank and wealth, purple remained in great demand. Several new hues of purple or crimson were introduced by the textile trade, along with the use of new fabrics such as silk dyed purple (Sebesta 2001, 69). Sebesta explains that “purple, in order to remain a status color had to evolve new hues, for as its older hues became more common, they lost some status” (2001, 71). This created the need for a wide spectrum of purple (Lat. purpura) colors in antiquity, achieved by various methods and color combinations of ingredients.

Pliny mentioned that there were various recipes for obtaining different shades of color and some are more expensive to produce than others. He informs us of some substitutes of purple current in Imperial Rome:

The reason why the dark purple [pretiosissimae purpurae] of Pozzuoli is more highly praised than that of Tyre or Gaetulia or Laconia, places which produce the most costly purples, is that it combines most easily with hyssginuma and madder which cannot help absorbing it. The cheapest comes from Canosa. The price is from one to thirty denarii per lb. (Nat. Hist. 35.26.45 [Jones])

To vary the murex purple, the purpurarius added urine or mixed it with other colors from plants or insects (Sebesta 2001, 69). When dyeing purple, if “the dye is boiled enough, it becomes quite purple, gay, and bright,” according to Aristotle (On Colours 32–33 [797 a]). Some of the purple hues used in antiquity are described by ancient writers (Vitruvius, Arch. 7.13.1–3; Pliny, Nat. Hist. 9.61, 137; 21.27; 21, 45–46) and listed as follows: alter (dark purple from murex; Vitruvius, Arch. 7.13.1); purpura tyria (tyrian purple from murex); purpura dibapha tyria (vibrant Tyrian purple “double dyed” from murex pelagium + murex bucinum; Pliny, Nat. Hist. 9.137); lividus (pale purple from murex; Vitruvius, Arch. 7.13.1); violaceus (violet purple or amythyst from murex conchylium; Vitruvius, Arch. 7.13.1; Pliny, Nat. Hist. 21.22.45–46); conchyliatus (pale lavender from murex conchylium; Pliny, Nat. Hist. 9.137); ruber tarentius (red purple from murex conchylium; Vitruvius, Arch. 7.13.1); thalassinus (blue/green/purple from murex); indicum (blue purple from indigo plant [Indigofera tinctoria];

The Leyden Papyrus X described the production of imitation purple dye (Caley 1926, 1149–66). And as McGovern and Michel point out, “since a goal of the dyeings was to produce less expensive substitutes for royal purple, these papyri likely describe plant—or insect—derived dyes rather than molluscan royal purple” (1990, 154). The demand for luxury hues was so great that counterfeit dyes were created from vegetable dyes (Pliny, *Nat. Hist.* 22.3) and various combinations of indigo (produce from either the woad [*Isatis tinctoria*] or the indigo plant [*Indigofera tinctoria*]), wild madder (*Rubia peregrina L.*) plant and Kermes (insect) were known to replicate purpurea Tyria, confirmed by the discovery of unspun wool, found in the Bar Kokhba caves (Yadin 1963, 173, 279; Wild 1970, 81), Masada (Koren 1994a, 257–64), and the chemical dye analysis of about 300 textile from the Nabatean fort ‘En Rahel on the Spice Route from Petra to Gaza (Koren 1999, 130). To produce the purpura Tyria shade of purple, the textiles must be double-dyed with wild madder (red) and indigo or woad (blue).

Koren concludes,

The presence of purpurin-rich madder roots together with indigotin for the production of “fake purple” in the ‘En Rahel textiles can now be clearly established as a deliberate technique and not an inadvertent aspect of the dyeing process in the Roman era. . . . The color and dye analyses have shown that the dyer, spinner and weaver were able to produce so-called “fake” purples and violets that mimicked the more expensive and more difficult to produce “real” colors from murex sea snails. (1999, 132, 135)

Thus, various dyes were combined to produce the desired fake colors, perhaps to fool the consumer into thinking they were purchasing a more expensive textile, or to be able to sell a textile for a less expensive price. The cost drove the economy of the dyeing industry and created a full spectrum of purple colors made from a large range of products. However, like today, for a wealthy clientele the murex purple would still have been in demand.

### The Rated Value of Purple Dye

Ovid portrayed those wearing clothes dyed with the double-dipped purple dye of Tyria (*purpura dibapha Tyria*) as a vulgar exhibition of wealth (*Art of Love* 3.170–92). Pliny reported that when

the violet purple was in favour, a pound of which used to sell at one hundred denarii (ca. 90 BC); and not long after the Tarentine red was all the fashion. This last was succeeded by the Tyrian *dibapha* [twice dipped], which could not be bought for even one thousand denarii per pound. (*Nat. Hist.* 9.63)

The Gospel of Matthew (last quarter of the first century) reported that a denarius was equivalent to an average day’s wage (20:2–13). The Diocletian Edict of Maximum Prices (AD 301) listed the daily wage for most experienced tradesmen, such as carpenter, baker, blacksmith, stone mason, wagonwright (§ 7.1–14), tailor of silk and teacher at 50 denarii (§§7.49, 64–66, 69). One pound of gold was 50,000 denarii (§30.1). The same Edict listed 16 prices in section 24 and 49 prices in section 29 of the various purple textiles. It recorded that the “prices [were] sold after a reckoning of the quality of the purple” (§29.49). The price for one pound of raw silk, dyed purple was 150,000 denarii, three times the price of gold (§24.1); one pound of wool dyed purple was 50,000 denarii (§24.2); one pound of wool dyed bright Tyrian purple was 16,000 denarii (§24.4); while one pound of bright Tyrian purple was priced at 10,000 plus denarii (§29.2–3). In addition, one pound of authentic double-dyed Milesian purple wool of the finest quality, was sold for 12,000 denarii (§24.6), extremely expensive compared with luxury garments from other places. The Edict implied that purple wool was an exported item, since home markets would not require such an edict (Graser 1975, 5:307–421).

What is significant to note is that Tyrian purple was among the least expensive purple dye and not the most expensive, but still a considerable price compared with the daily wage. The Diocletian Edict indicates that purple
dye and products had a wide price range supporting a wide product line.

Based on experiments by the German chemist Paul Friedlaender in 1908 (1909, 247), Jacoby reports that “twelve thousand snails of Murex brandaris yield no more than 1.4 g of pure dye, enough to colour only the trim of a single garment” (2004, 210). Based on laboratory experiments conducted by Koren he reports that: “To dye a kilogram or more of one entire royal or priestly robe, cloak, mantle, toga or other garment (‘from head-to-toe’) to a deep shade would require a total of about 10,000 snails” (2005, 146).

These quantities and prices would make the purple dyeing trade very lucrative and textiles dyed with this color very valuable (Milgrom 1983, 61–65). Commentators conclude that Lydia must have been a wealthy business woman and her wealth did not need to depend on murex dye alone.

The Demand for Purple Textiles

An Egyptian papyrus recounts the saying that “from his clothes it is clear what sort of person he is” (Minnen 1997, 598). Broughton describes how the wealthy Lydian clothing industry flourished under the Pergamene Empire. He explains,

Figure 6. Man wearing an all-purple toga picta (paludamentum), from an Etruscan wall painting from the François Tomb at Vulci (about 350 BC). The boy is wearing a collobium with a purple clavus angustus. Public Domain.

Lydian industry with its art of interweaving gold thread in the cloth that the Pergamene kings developed at Pergamum and in their own workshops (Dittenberger et al. 1915, §3.1018) until Attalic curtains, tapestries, and vestments became one of the leading articles in a luxury trade . . . [and] they probably produced cheaper garments as well. (1975, 4:818)

As Pleket points out “luxury textiles were a desideratum [desired] not only for the senatorial and equestrian elites of Rome but also for the elites in the hundreds of other cities in the empire. Mare nostrum [our sea] facilitated the trade” (1998, 128). Purple accented garments featured in the quest for fashion in the Roman period. This was the “cog that drove” the murex industry, regardless of the production location.

Purple was used in a variety of Roman clothing, including the various outer garments of togas (τήβεννος) and inner garments of tunics (χιτῶν, dim. χιτωνίσκος, χιτώνιον). Purple was used by a wide economic range of Roman society, creating a high demand and wide spectrum of cost for the color. The various types of garments decorated with purple included the following items.

Togas

The toga praetexta, was introduced in approximately 63 BC and decorated with a purple border (Lat. clevi; Livy, Hist. Rome 34.7.1–3; Sebesta 2001, 69). This outer garment was worn by boys and girls to distinguish them from adult Roman citizens (Anderson 1891, 2:849; Edmondson 2009, 26). The only adults allowed to wear this toga were curule magistrates. Lentulus Spinther used double-dyed (Lat. dibapha) Tyrian purple in his toga praetexta when he was made curule aedile (Sebesta 2001, 69). Any family who had children would have need of a garment with purple dye. Depending on the financial status of the Roman family there would have been a market for purple products of various prices.

The toga picta, or toga palmate (see fig. 6), which was ornamented with Phrygian purple and gold embroidery, was worn by military commanders during their triumphs, and by the consuls under the emperors, along with the praetors during the celebration of the games (Anderson 1891, 2:849; Edmondson 2009, 26). Roman authors document how the Etruscan and Lydian kings were known to wear gold decorated purple tunics and mantles (Dionysius, Ant. rom. 6.95.4; cf. 3.61.1; Livy, Hist. Rome 1.8.2; Strabo, Geogr. 5.220). It is difficult to imagine that these kings would have used imitation dye for their tunics.
Polybius described the place of purple in the dress of triumphatores at an aristocrat’s funeral: “These representatives [the actors] wear togas with a purple border if the deceased was a consul or praetor, whole purple if he was a censor, and embroidered with gold if he had celebrated a triumph or achieved anything similar” (Hist. 6.53.7–8 [Paton]).

The trabea, was a toga that was variously decorated with purple, from being entirely dyed in purple (Tacitus, Ann. 3.2), to one dyed in purple and saffron for augurs, to a white toga with purple stripes (clavi, Virgil, Aen. 7.612) and worn by the more distinguished members of Roman society, along with deities and emperors for special occasions (Pliny, Nat. Hist. 8.49; 9.39; Virgil, Aen. 7.187, 11.334; Ovid, Fasti 2.504; Anderson 1891, 2:849).

Tunics

Roman tunics, worn as the inner garment, were also ornamented with purple stripes (Lat. latus clavus; Varro, Sat. Men. 313) of various widths (Anderson 1891, 2:849; Cleland, Davies, and Llewellyn-Jones 2007, 6; Jørgensen 2010, 75); although not on togas as some have claimed (Fantham 1999, 111). It is believed they were introduced during the reign of Tullus Hostilius (reign 673–670 BC), after his conquest of the Etruscans (Pliny, Nat. Hist. 9.63; Suetonius, Otho 10.1). They were a prominent symbol of the senatorial order (latum demisit pectore clavum, Horace, Sat. 1.6.28; Ovid, Trist. 4.10.35; Suetonius, Aug. 38) and of people of status and wealth (Statius, Sylv. 4.8.59; Suetonius, Vesp. 2; Tacitus, Ann. 16.17; Pliny the Younger, Ep. 2.9). The width of the purple stripe was an important status symbol (Cleland, Davies, and Llewellyn-Jones 2007, 35).

Although the nature of the latus clavus was debated, Rich and Flather confidently state that “it is agreed by antiquarians that the clavi were purple stripes [tunica laticlavia] woven in the fabric . . . or sewn on it ([Ulpian] Dig. 34, 2, 23, §1; 19, §5); that they were employed to ornament the tunic, and no other garment” (Rich and Flather 1890, 1:454). The purple stripes (Lat. latus clavus) have been archaeologically verified by textiles recovered from archaeological sites, such as the Cave of Letters, opposite the Nahal Hemar Cave near the Dead Sea in Israel (Summer and D’Amato 2009, 217).

Summer and D’Amato describe the tunics made from three different colors that contain purple:

there is a red tunic with dark purple clavi (preserved in a single sheet); this echoed the tales of the Talmud about the red tunics of the Roman soldiers. This tunic is, in its preserved shape, 58 cm wide and 78 cm long. Then there is a mauve tunic with faded purple clavi, preserved with two of its sheets still sewn together, a slit for the head and the stitching at the selvedges. The third tunic is beige with dark red clavi. (2009, 217)

According to Abrahams and Edelstein, and subsequent analysis of the textiles from the Cave of Letters, the purple color was dyed with indigo and madder root prior to weaving the fabric and not sewn onto the tunic (1963, 270–79; Yadin 1963, 211; Jørgensen 2010, 76). Parts of tunics found in the Murabba’at Caves, in the Judean Desert, also revealed they were double dyed, utilizing the murex shellfish, Hexaplex trunculus, and the Cochineal insect (Sukenik et al. 2013, 46–54).

In addition, 74 different bundles of yarns from Masada have been analysed for the source of the yarn colors. Koren reported that “essentially all the purple-shaded dyeings contained madder, and all of these dyeings, according to the HPLC determination of its relative dye content, contained a purpurin-rich madder [Rubia tinctorum L.]” (Koren 1994a, 262). However, one additional sample from Masada, indicated that the yarn had been dyed with murex, most likely the Murex trunculus, leading Koren to speculate that the fabric may have belonged to King Herod (Koren 1997, 23–34). To date, this is the only example of fabric dyed with murex in Israel (Koren 2005, 136–49), but it does indicate the presence at the same site, of fabrics dyed with murex shellfish and madder root. Both types of dyes were identified at the same location on different fabrics.

The purple stripe of the tunic (Varro, Sat. Men. 313), not the toga, as some have suggested (Garnsey and Saller 1987, 114), was the adornment of the equestrian order (Lat. Augustus clavus; Rich and Flather 1890, 1:453–56; Jørgensen 2010, 75), but were also worn by the children of equestrians (Ovid, Trist. 4.10.29). Senators were distinguished by the broad purple stripe on their tunic (Rich and Flather 1890, 1:453–56). Prior to its adoption by Tullus Hostilius, it was “worn by all ranks promiscuously” (Pliny, Nat. Hist. 33.7).

Argument for Lydia Not Involved in a Dyeing Facility

The purple trade seems to have been quite prominent in Philippi (PV PRVRA; CIL 3.664.1; Mommsen 1974 §3.664.1; Lemerle 1945, 28). Barrett speculates that “it is
not clear whether Lydia was a sort of commercial traveller in purple cloth, who visited Philippi frequently enough to know her way to the place of prayer, or had opened a retail establishment there” (2004, 2:782). Joshel suggests that most individuals, both produced and sold purple goods from the same fuller’s shop (fulonicae) (1992, 71).

**Did Not Produce the Goods Where They Conducted Their Business**

However, this is challenged by Hughes, who provided new research, derived from the inscriptive evidence, that the shops in Vicus, where Pubius Clodius Philonicus’ wife Eurania was carried out her business of Purpuranii, was not suitable for producing the goods (2007, 89). She argued that the odor (see below) and size of the location needed to carry out the dyeing process, made it impossible to have had the manufacturing shop located in Vicus. Also, Hughes demonstrated from an examination of the literary, epigraphic and archaeological evidence of purpurarii in Rome that “members of their familia could produce or sell a number of goods, other than textile, from their workshops” (2007, 82), including foodstuffs, along with dye and pigments for paints (Pliny, *Nat. Hist.* 36.26.45; Vitruvius, *Arch.* 7.13.2–3).

Similarly, Lydia was probably selling a variety of purple goods in Philippi that were manufactured elsewhere. If she was producing the purple products in Philippi, the dyeing process normally required a large installation, that was well ventilated (Hughes 2007, 88; Schmid 1999, 275–78), although a small number of sites have demonstrated that the production of purple dye was “carried out on a small-scale by households” (Becker 2001, 123). This suggests that Lydia likely did not dye her goods in Philippi unless at home, but rather her purple cloth was doubtlessly imported from a dyeing facility, perhaps from Thessalonica near Philippi (Keener 2014b, 370). However, Philippi was only 7.75 miles (12.5 km) from the coast and she could easily have had the murex shells transported overland from the coast, if she was involved in a dyeing facility. The use of murex dye did not require that the facility was on the coast.

**Arguments for Supplying a Local Need**

The occurrence of guilds and dye facilities, indicated above, with the occurrence of isolated dyers, fullers and wool workers indicate that in most Asia Minor towns there were “one or two experts who could find a living by supplying a local need” (Broughton 1975, 4:821). In Philippi in Greece, there were several groups that also had need of purple textiles.

**Jewish Community at Philippi**

Although Philippi’s population was predominantly Greek, there was a small Jewish community, evident from Acts 16:13. Luke reports that

> on the Sabbath day we [Paul and his associates] went outside the gate [of Philippi] to the riverside, where we supposed there was a place of prayer (προσευχῆς), and we sat down and spoke to the women who had come together (συνελθοῦσαι). (Acts 16:13 ESV)

Although there are no other NT instances of the use of the term “place of prayer” (προσευχῆς), extra biblical writers used the term to describe synagogues (Josephus, *Vita* 277; Philo, *Legat.* 155–58; see also Reimer 1995, 87, 89, 90), and a recent discovery of an inscription does reveal the existence of a synagogue in Philippi in the third or fourth centuries AD (Koukouli-Chrysanthaki 2009, 26–29; 2011, 451).

The fringes (ṣīṣit) of the Jewish prayer shawl (tallit) worn by Jews every day in the Synagogue for prayer was colored purple/blue (Heb. תכלת; Num 15:38–39) with murex dye (Heb. ארגמן). Lydia would have had a Jewish clientele for her purple products, albeit small, among the other ladies she met with for prayer by the riverbank in Philippi (Acts 16:13).

**Purple Worn by the Praetorian Guard**

The Praetorian Guard (Lat. Praetoriani) were the imperial bodyguard of Rome, whose primary responsibility was to guard the Roman emperor and his family. Augustus created them and gave them the name praetorian cohorts (Lat. praetoriae cohortes), as they were to guard the Roman general (Lat. Praetor), along with, as Bingham points out, “policing the games, assisting in fighting fires, protection (and often surveillance) of the imperial family, and the confinement of criminals” (1997, 39; Tacitus, *Ann.* 1.77.1; 6.13.1; Suetonius, *Tib.* 37.2). Paul acknowledged the presence of the Praetorian Guard (Lat. Praetoriani) at Philippi in his letter to the church there (Phil 1:13). In 30 BC, Octavian became Roman emperor, reorganized the colony of Philippi, and established more settlers there, veterans possibly from the Praetorian Guard and other Italians (Hendrix 1996, 5:314). According to
the Nile mosaic of Palestrina, the Praetorian Guard\textsuperscript{41} wore a reddish purple\textsuperscript{42} sleeveless tunic, along with a red/purple festoon helmet (Rostovtzeff 2008, 276; Summer and D’Amato 2009, 21).\textsuperscript{43} The color of the army was the always-present red, which the ancients called red-purple. According to Martial “Rome wears more browns, Gaul reds [raufs]; and boys and soldiers like this color” (Epig. 14.129 [Shackleton-Bailey]). Lydia would have had clients for purple garments from the Praetorian Guard.

**Conclusion**

It becomes clear that various textiles were dyed using different methods and combination of dyes depending on the color, quality and value. More expensive dyes, such as Tyrian purple, allowed for more expensive clothes, while more economical dyes provided for less expensive textiles. The diverse purple dyed product line, formulated from the various shades of purple, provided a wide range of textiles from various prices to meet the demand in the local and general economy. While it is possible that madder root alone was used to dye textiles purple in Laodicea or Philippi, it is more likely that both madder and murex, along with other ingredients were used to provide a wide selection of variously priced textiles, since murex shellfish were accessible inland, through trade.

Thus, it is fair to argue that Lydia likely did not deal in just one type of dye or method, but used a combination of dyes to participate in the competitive market of her day. Given the everyday use of togas and tunics, with purple clevi in Roman society, along with the more specialty groups, such as the Jewish and military community in Philippi that used purple garments, Lydia would have had a market for a wide price range of products to offer her customers. There seems little doubt that she would have either employed or purchased textiles, dyed from both madder, as well as murex, to meet the demand of her clients. To demand that her products were only madder dyed seems to argue against the evidence.

It seems likely that Lydia was a wealthy woman who learned her trade in Thyatira and moved to Philippi to carry on her business. She not only dealt in purple textiles, made from madder root, but also from the murex shellfish, since there was a demand from many in Roman society for a diverse quality purple cloth that was also available inland.

**Notes**

1 I would like to thank my wife Irina for reading the text and providing helpful suggestions along with Cvi Koren for his helpful comments about the dyeing process.
2 Some of the cities in these provinces involved in the clothing industry include Thyatira (Lafaye 1901, §§4.1239, 1242, 1213, 1250, 1250, 1265; Edson 1972, §291), Sardis (Athenaeanus Deipn. 6.255; 12.514), Erythrea, Clezomenae, Phoceca, Cophon, Smyrna, Coan, Samian, Mithlene, Miletus, Saitae, Ephesus, Tralles, and Miletopolis.
3 Pliny stated that Sardis was credited with inventing “the art of dyeing wool” (Nat. Hist. 7.56.195), although Broughton suggested that it “probably means the first use of madder root for that purpose” (1975, 4:818). The taxes that dyers had to pay were calculated at 24 drachmas a month, while traders of junk had to pay 8 to 12 drachmas, which indicates that they were a significant economic trade in Roman society (Drob-Krüpe 2016, 335).
4 Calpino estimated that “the 103 inscriptions that contain references to purple trade [τορπόρα], twenty-nine percent are from Asia Minor” (2014, 199a81) and many of these were from Thyatira. There is also evidence of the dyers guild in Phrygian Hierapolis (Frey 1952, §2.36) and Ephesus. See Trinkl (2007, 81–86).
5 Ancient terminology of the dyeing trade is imprecise, so the following distinctions will be made to help clarify and be consistent with terms: dye-makers are those who manufacture the dye; dyers (lavarnou, lanarii carminatores) are those who treat the textiles with the dye to produce the various colors; dye-sellers (τορπυροπτολις, Lat. purpurarius) are those who sell dyed textiles, while dye-dealers designate who are involved in selling more than one product (i.e., dyed textiles, pigments for paint, etc.). According to Cleland, Davies, and Llewellyn-Jones, the Greek term halourgopóleis is defined as “a trader or seller of purple dye, or cloth or thread pre-dyed purple” (2007, 88).
6 The term murex is used here in a broad sense to indicate the molluscs that produce purple dye.
7 Horsley assumed that the government has a monopoly over the “royal” purple (1982, 28). However, this was only introduced late in the Roman Empire. Keener states in the *IVP Bible Background Commentary* (1993) that the dye was “procured from the murex shellfish near Tyre, but in Macedonia it could have been procured from the mollusks near Thessalonica” (1993, Acts 16:15). However, in the newer edition Keener adds, “Thyatiran purple often came from the madder plant, not the more expensive Tyrian shellfish” (2014b, 370). Keener holds to this updated view in his *Acts commentary* (2013, 2:2396). See also Lenski (1961, 656–57), and Bruce (2000, 220).
9 In his commentary on *CIG* §3496 (Böeckh 1877), Waltzing mentions Lydia’s profession (Acts 16:14) and comments “La teinture rouge de Thyatire était renommée [the red dye of Thyatira was famous]” (emphasis added; 1895, 3:57).
Lydia’s Purple

11 For a general list of Mediterranean coastal purple dye centers, see Reese (1980, 82; 1987, 201–5) and Cleland, Davies, and Stears (2004).


15 Hemer claims “that this term is not known otherwise from Thyatira,” but this inscription would qualify as another (2001, 109).

16 Rabbi Isaac Herzog coined the term Porphyrophyll (the study of purple) in his 1913 doctoral dissertation about Hebrew Porphyrophyll (1919).

17 In Crete, the sites excavated include Koupounissi, Karoumes, Palaiakastro, Kommos, and Chryssi. For details, see Alberti (2008, 76), and Apostolakou, Brogan, and Betancourt (2012a, 179–82; 2012b, 187–92). In Italy, the sites excavated include Potออกไป, Eratria, Tarentum, Ostia, Monte Ciceo, Pompeii, and Rome. For details, see Wild (1970, 79–82), Schmid (1999, 278), Reese (2002, 292–314; 1980, 86), and Hughes (2007, 87–92). In Syria, the sites excavated include Tell Rifa’at, Minet d-Heidha, Arabus, Qatna, and Ugarit. For details, see Thureau-Dangin (1934, 137–46), Seton-Williams (1961, 68–87; 1967, 16–33), Reese (1980, 82) and James et al. (2009, 1109–18). In North Africa, the sites excavated include Sidi Khrebish and Benghazi (Berenice). For details, see Reese (1980, 87–92), Kenrick and Bailey (1985), and Lowe (2004, 46–48).

18 In Lebanon, the sites excavated include Byblios, Sidon, Sarepta, and Tyre (2 Chr 2:7–2:9). For details, see Fritchard (1978), and McGovern and Michel (1984, 67–70; 1985, 1514–22). In Israel, the sites excavated include Neapolis, Lydda, Tel Akko, Haifa, Tel Dor, Luz (Sot. 46b), Tel Shiqmona, Tel Be’er Mirosim, Tel Keisan, Tel Kabri, En-Boeq, Tel Mor, and Caesarea. For details, see Dothan (1996, 3:889–90), Karmon and Spanier (1988, 184–86), Koren (1993, 25–33; 1995, 118), Wiseman (1996, 89–90), Barako (2007, 233–35), and Feliks (2007, 76–77). In Cyprus, Enslams or Salomi have been excavated. For details, see Reese (1978, 1–12), and Daniels et al. (1989, 153–54). Regarding Egypt, see McGovern, Lazar, and Michel (1992a, 69–83), Koren (1995, 119), and Cardon et al. (2011, 197–214). In Turkey, the sites excavated include Kos (Boeckh 1877, §2519 = Lafaye 1901, §4:1071), Istanbul, Troy, Andrae (Forstenpointner et al. 2007, 201–14), Apierlae, Hierapolis in Phrygia (Strabo, Geogr. 13.4.14), Phocaea, Teos, Pergamum, Ephesus, Miletus, and Pontus on the Black Sea coast. It is certainly true that ancient sites (i.e., Ephesus and Miletus) were closer to the coast in antiquity and today are found further inland due to the silting of their harbors. Still many of the cities are located a considerable distance from the coast. For details, see Reese (1980, 82) and Koren (1995, 119).

19 Eleven fullonicae have been excavated in Pompeii and three in Ostia, guild was called Corpus Fontanorum. For the debate over the role of the fullonicae in textile production, see Wilson (2003, 442–46), Flohr (2003, 447–50, 2013, 53–78), and Bradley (2008, 21–44).
Edmondson (2009, 27, 29n43) points out that Varro “mocks those who wore transparent togas to show off the broad stripe on their tunic” (Sat. Men. 313 [Bücheler]).

The Fullonica of Stephanus (Fullonica Stephani) that is situated on the south side of the Via dell’Abbondanza is the only laundry (fullonica) in Pompeii. Only 103 murex shells were discovered in Pompeii, leading to a variety of opinions on the dyeing capabilities. See Reese (2002, 296–98).

One example is the small-scale facility at the Middle Bronze Age tell at Ayios Mamas in Greece.

In light of the tradition of Lydia and the other women meeting at “a place of prayer” outside the city by the riverbank, some have inferred that the first-century Jewish community in Philippi was not large enough (10 men or a minyan) to sustain a synagogue (Stambaugh and Balch 1986, 155–56). However, this stipulation of 10 men was a later rabbinical regulation that postdated Lydia and women were permitted to read the Torah in public and counted as members of the synagogue quorum (Brooien 1982, 94). Also, it was Paul’s practice to seek out the synagogue during his missionary activities and Paul expected to find the synagogue there.


Summer and D’Amato claim that “it is not widely accepted that the Palestina mosaic or the Domus Aurea fresco shows praetorians, although the evidence of the shield should confirm this identification” (2009, 259n924).

According to Meyboom, the color was a brownish-yellow, but had faded considerably since it was first created (1995, 269, 271n165).

Today, the festoon helmet is used as the official unit insignia of the US Air Force Presidential Honor Guard.

References


Fischer, David Hackett. 1970. “Biological Precursors and Biological Field Survey in Andriake (South-West Turkey).” Studies in Ancient Technology 30, no. 3 (March): 247.


