CHAPTER 13

Workshops and Technology

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13.1 Craft Workshops and the Community in the Greek World

Within the bursting artisan quarters of ancient cities, skilled workers turned metal, stone, clay, textiles, leather, ivory, and other materials into a variety of objects to be used in the house, worn at the battlefield, dedicated in the sanctuary, or offered in burials or at tombs. The tools, techniques, technology, workshop organization, and spatial layout required have changed little over the millennia, especially before the use of electricity. A modern potter, and for that matter most other artisans, could have operated and collaborated with his craft associates around an ancient workshop rather comfortably. But despite the ease of the modern craft practitioner, the modern archaeologist could not face more challenges in the correct identification and interpretation of craft installations and techniques. Our archaeological inquiries have approached the world of production in a somewhat fragmentary manner: from iconography of objects to microscopic analysis of the raw materials themselves. When archaeologists turn their attention to the human agents, the workmen who transformed raw materials into finished products, there are two sets of evidence to confront: (i) representations of (mainly) craftsmen at work on Athenian vases and Corinthian plaques; and (ii) references in ancient texts (e.g. philosophers of the 4th c. BC, encyclopedists and travelers of the first two centuries AD). Both the pictorial evidence (Ziomecki 1975; Zimmer 1982a; Jockey 1998; Hasaki 2002; Vidale 2002; Papadopoulos 2003; Hadjidimitriou 2005; Ulrich 2008; Williams 2009b) and textual references
Forms, Times, and Places

(Müller 1974; Neesen 1989; Roochnik 1996) have been discussed in great detail. A burgeoning scholarship on ancient technology from Prehistoric to Byzantine times is also available (e.g. Burford 1972; Humphrey et al. 1998; Ling 2000; Evely 2002; Oleson 2008).

For the purposes of this chapter, we will focus on three locales – namely, the workshops of a potter, a bronze-sculptor, and a marble-sculptor. For each of these areas of ancient craft, we will attempt to understand better, on the one hand, the technology itself and, on the other, the people and locations involved. We will also emphasize the common body of knowledge on techniques and materials that many craft practitioners share and their interdependence, an aspect sometimes forgotten in focused surveys of specific crafts. Two representations of an Athenian pottery workshop can serve both as anchoring points for our discussion on workshops and technology and as cautionary tales on how to reconstruct fully-functioning workshop contexts from the existing lacunose evidence: a depiction of potters at work on a black-figured Attic hydria of the later 6th c. BC attributed to the Leagros Group and now in Munich (Boardman 2001a: fig. 174) and an imaginary reconstruction of an Athenian pottery workshop by a French artist from the early 20th c. AD (Vidale 1998). The sharp contrast of the composition, style, and character of these two artistic renditions makes them hardly comparable, but they represent satisfactorily some of our scholarly attitudes to ancient craft workshops and their technologies: some approaches deal heavily with what evidence (textual, archaeometric, archaeological) we have from the past, and others tend to augment the existing evidence with some imaginary and even idealizing notions. As a result, our reconstruction of ancient technologies, workers, and workshops can be at least as likely and believable as the one drawn in the early 20th c., unless we use all available and relevant evidence and methods to recreate the world of ancient crafts. Our interests in the customers of these vases both at home and abroad, and in connoisseurship (Beazley 1956, 1963), although important in their own way, detract us from considering the everyday life of the workshop itself.

13.2 The Potter’s Workshop

Once inside any craft workshop, the composition of the crew becomes an important issue. From the surviving artisans’ signatures and the depictions of craftsmen at work, it seems that the vast majority of ancient workshops were ‘manned’ by males (cf. Figure 13.1). Only one woman decorating the handles of a volute-krater on the 5th c. BC Athenian red-figure Caputi hydria (ARV 376.61) indicates that women may have played a role in the decoration of vessels, or even in the production of mold-made objects; it is possible they worked
from home and transferred their products to a family workshop to be fired. Painting, whether on vases or on panels and walls, seems to have been popular with women, and ancient authors do mention a few female artists, all daughters of established painters (e.g. Plin. *HN* 35.136).

The potter who fashioned the vase and the painter who painted it often left signatures of their respective tasks. What about the rest of the crew, who did not sign the vases in any capacity, but greatly contributed to their production? No potter, to our current knowledge, left behind a handbook of how to run his establishment. Instead, it is the Greek philosophers Plato and Aristotle, the Roman encyclopedist Pliny the Elder, and the Greek traveler Pausanias who refer occasionally (and always with admiration) to craft apprenticeship (Burford 1972; Hasaki forthcoming, b). But their attitudes towards the subject are not equally lofty. Aristotle states, ‘Crafts are teachable; otherwise, good craftsmen would be born, not made’ (*Eth. Nic.* 2.1). The potter’s learning curve, especially, was paradigmatic for the Greek philosophers, who used it as a metaphor for the steady, methodical, and patient acquisition of knowledge they sought to inculcate in their own students. As Plato (*Grg.* 514E; *Lach.* 187)
warns us, ‘You should not learn the potter’s craft by first forming a very large vessel, the pithos.’ Similarly, a student of any field (mechanical or intellectual) should acquire skills in a structured sequence and not skip to the most difficult task with no prior experience. The qualities of hard work, patience, perseverance, learning from errors, and gradual acquisition of skills, critical for a successful artisan, were equally essential for a craftsman, orator, or statesman.

The iconographic evidence shows primarily artisans in major roles (masters) and others in subsidiary roles, where it is not always easy to differentiate younger skilled assistants from apprentices, from unskilled laborers. One representation is particularly helpful. On the shoulder of the Caputi hydria mentioned above are two younger, beardless painters, who must be at the beginning of their artistic careers and appear to be responsible for the palmette ornamental zones on two kraters. The apprentice vase-painter would have needed to learn the spatial division of a vessel, what visual element to use as a boundary marker, and how to choose the appropriate design configuration within each spatial division. Learning the decoration syntax of a vessel would have been a long process. Templates were often used to make border designs such as ivy leaves on the Caeretan hydriai of the Archaic period (Hemelrijk 1984). From pattern-work, one could move up to animals, to secondary figures (or ‘mantle figures’ as they are often called in vase-painting), to rendering a known theme masterfully in all its components from pattern work to figural scenes (Beazley 1989: 53). Apprenticeship was not always a relaxed, lofty, and pleasant phase as the Caputi hydria suggests. Punishment associated with apprenticeship may be detected in a highly unusual scene on a Boeotian skyphos dated to c. 400–390 BC (Daumas 2000). It would be a usual workshop scene, with two potters working on the wheel and two workmen transporting vessels to stack them, were it not for a figure literally hung horizontally from the ceiling. Is this a true depiction, or a visualization of a verbal threat that the master potter repeated endlessly to young apprentices?

The potter, both during his apprenticeship and later, spent most of his time around the wheel (Gr. ἔρωσ). This is the place where he threw, built, and fashioned his objects, and when he was the one decorating them, he also used the wheel as a turn-table. No complete potter’s wheel has survived from Greek antiquity. Illustrations of potters working at the wheel and excavated parts of a wheel fill the gap (Vidale 1998; Vidale 2002). Its appearance and operation is reconstructed from paintings on Corinthian plaques and Athenian vessels from the Archaic and Classical periods. On both the Corinthian and Athenian depictions, the potter is usually shown seated next to the wheel, with the wheel head either above or below his knees. Only in the Athenian representations is there also an assistant who helps turn the wheel, while the potter shapes the vessel upon it. It has been suggested that the extant depictions of potters’ wheels, few though they are, represent two different types: a lighter wheel and a heavier wheel (Vidale 2002). The lighter wheel had smaller dimensions and
could spin faster for the throwing of delicate vessels, such as kylikes; the heavier, larger wheel was slower, but could sustain a stable momentum longer, thereby enabling the potter to throw larger, more time-consuming vessels. The wheel was therefore a highly specialized piece of equipment and was configured specifically for certain sizes and shapes of vessels.

Extensive experimental studies of throwing on a replica of an ancient wheel and of decorating different shapes can provide another point of reference for the output of Athenian potters and painters, the organization of the workshop, and the overall scale of production. Already in the 1940s, Beazley urged scholars to study the potters of the Attic vases, after an intensive study of the painters, so that the entire craft could be better understood. So far we have trained our eyes better than our hands: vases of widely different dimensions have been illustrated in books in equal size, in order to place emphasis on the scene depicted on them. Scholars of ancient Greek pottery tend to publish studies on the chronological development and the function of a certain shape, or on iconographical themes that appear on different shapes. By looking at the Greek vase-paintings with a magnifying glass for mythological, political, and social messages, sometimes we forget that a miniature frieze of figures (less than 0.04 m) on an Athenian Little Master cup requires different skills and speed than a megalographic scene with figures taller than 0.2 m on a red-figured krater or hydria (Williams 1985). Similarly, the special demands placed on the potter for throwing a kylix (c. 0.16 m in height and sometimes with a diameter of 0.33 m) or a volute-krater (c. 0.7 m in height), as well as the time investment for producing these two distinct shapes, have not been fully explored. Juxtaposition of sizes of shapes and scenes in their respective scales allows the different suites of skills required by potter and painter to become more distinct and pronounced.

In this light, the phenomenon of specialized signatures by the potter and the painter of a vase acquires a more practical significance in addition to the artistic. In the vase-painting of the Archaic period (both in Athens and much less at Corinth), we find a further division of labor reflected in the signatures: the maker of the vase and its painter, indicated by *epoiesen* (‘made’) and *egraphsen* (‘painted’) signatures (Cohen 2001; see Chapter 30). These two processes were considered quite distinct in the skill required and time involved; when the same person executed both stages, this was clearly indicated by their signature, as in the case of the Athenian black-figure artist Exekias, who sometimes signs: ‘Exekias made me and decorated me’ (Boardman 1974: 57). Pottery is the only craft where a third verb, specific to the working of clay, *ekerameusen* (‘potted’), is occasionally used. Beazley estimated that approximately 140 names of potters and painters are known (1989: 54), and while for some of them, like Nikosthenes, we have over 100 signatures preserved, almost half are known by only one surviving signature (Tosto 1999). The standardized signature ‘so-and-so *epoiesen*’ (‘so-and-so made’),
and the less common variant ‘autopoiea’ (‘own work’), is popular in many crafts (Williams 1995). At the same time, it should be remembered that master craftsmen in antiquity opted to create masterpieces in clay, metal, stone, or ivory, rather than write about them or about their craft secrets. In most representational arts, such as sculpture, gem-carving, mosaics, and paintings, the makers’ signatures, from their first appearance in the 7th c. BC, would simply showcase the main intellectual authorship that ‘so-and-so made’. Even in their signatures, they briefly celebrated the mastery of their craft without listing any apprenticeship credentials.

The firing of pottery, be it decorated or undecorated, can be understood based on both ancient and modern considerations. An ancient Greek kiln, whether of circular or rectangular footprint, consisted of six major structural parts, proceeding from bottom to top: the stoking channel, the combustion chamber, the intermediate perforated floor with its vertical support in the combustion chamber, the pot-firing chamber, the loading door, the dome, and the chimney. One of the ancient names for a potter’s kiln was kaminos, and both potters and poets used that term. A kiln is labeled as such on one of the plaques (pinakes) from Penteskouphia (Cuomo Di Caprio 1984; Hasaki 2002). In an ancient poem called Kaminos, a group of potters have an encounter with Athena during a firing. Athena proceeds to remind the potters of the all-too-well-known destructive forces of the five kiln daemons (Faraone 2001b).

The excavated remains of more than 500 kilns have given us much information about their internal construction, the kiln equipment for stacking vessels, and the type of fuel consumed (Hasaki 2002, 2006). The Penteskouphia plaques and a few Athenian scenes on vases provide us with precious and rare information about the upper parts of a Greek kiln, such as the pot-firing chamber, loading door, spyhole, dome, and chimney, all of which rarely survive archaeologically (Hasaki forthcoming, a; see Figures 13.2 and 13.3). A kiln is one of many methods of firing pottery. Other techniques include bonfires or open firings, simple depressions, and pit firings (Rice 1987). Compared to all of them, a kiln structure combines simplicity in design with maximum efficiency in fuel consumption and larger stacking capacity per unit area.

A recent experimental attempt by the author to construct a replica (at a 1:1 scale) of a typical ancient Greek kiln has shed light on some interesting issues (www.aiatucson.arizona.edu). Despite the extensive use of modern construction materials (over 2000 bricks), the size and design of this kiln faithfully replicate excavated remains and illustrations. In terms of capacity, even the smallest ceramic kiln (1.0m internal diameter of firing chamber) can easily hold up to 150 medium-sized vessels (c. 0.2–0.3 m in height, e.g. oinochoai). Regarding the total duration, the pots can be safely removed after the firing is over and the kiln has sufficiently cooled down (approx. 48 hours total). A refined control of temperature and atmosphere is ultimately what accounts for the characteristic
Figure 13.2  Black-figure plaque. A potter by his kiln. 6th c. BC (Paris, Louvre MNB 2858; drawing after Hoffmann and Boehm 1965: fig. 147).

Figure 13.3  Black-figure plaque. A potter working at a kiln loaded with pottery wares. 6th c. BC. (Berlin, Antikensammlung F893; drawing after Hoffmann and Boehm 1965: fig. 147).
ancient Greek slipped wares, since the kiln structure itself is very basic, and the
type was and still is omnipresent in the Mediterranean basin. As has been
described elsewhere, there was a single firing with three distinct phases of
unequal duration and temperature range (Noble 1988; see Figure 13.4). The
most critical period was the middle phase of reduction, where all air outlets of
the kiln were closed for 30–40 minutes while the temperature remained strong
above 800 °C. Such a firing technique ultimately results in the fine black- and
red-figure vases that have become hallmarks of the modern study of ancient
Greek art. The average kiln-load produced only a few, if any, masterpieces, and
a close look at museum showcases will easily convince us that many ‘defective’
vases (i.e. uneven firing, lime spalls, etc.) were still marketable and sellable
in their day. Black-and-white photographs of vases and detailed shots for
iconographical details mask these all-too-frequent firing accidents.

13.3 The Smith’s Workshop

The techniques and workshop installations of the ancient Greek metal-worker
follow logically from our discussion of pottery, since clay was important to
both, and since the kilns/furnaces (Gr. *kamins*) used in both crafts, albeit of different form and function, still manage to confuse archaeologists. The techniques of a bronzesmith, just like a potter’s, were few but highly efficient and appropriate. The techniques of hammering (*sphyrelaton*), lost-wax-casting, solid-casting, and hollow-casting served them well for centuries. For small-size figure or animal statuettes, the solid bronze-casting was the favorite method. Not many examples of the *sphyrelaton* technique have survived, except for the triad of supposed ‘cult figures’ found at the Temple of Apollo at Dreros, Crete, dated to the 7th c. BC (Boardman 1978: fig. 16; Romano 2000). But the steps of the solid- and indirect and direct lost-wax hollow-casting have by now been well understood (Mattusch 1996a, 1996b; Hemingway 2004; Mattusch 2008). In the solid-cast method, the object is first modeled in solid wax and encased in a clay investment. After the pouring of the bronze, both mold and model are destroyed; for each new casting, a new model and a new mold have to be fashioned. These figurines, as independently standing votives, or as attachments to impressive bronze tripods, were the most dominant dedications in major sanctuaries such as Olympia, especially in the Geometric period. Even in the early 7th c. BC, the votive Apollo of Mantiklos is a solid-cast bronze (Boardman 1978: fig. 10).

The artist roughly models his work in clay over a wooden armature. Then he applies a layer of wax over the clay core and renders all final details on this wax layer. He also applies a gate system, which will later facilitate the pouring of molten bronze. He encloses the clay core, the wax layer of details, and the gate system with a clay investment. The piece is placed in an oven to melt away the wax. Later, the sculptor pours the molten bronze from the top, and it reaches all parts of the piece through the gate system. The bronze can lose its fluidity quite fast, so the caster tries to prevent any accidents by adding lead to the bronze alloy in order to prolong its fluidity, and by casting sculptures in smaller pieces. In the lost-wax direct hollow cast, once the model has been created and encased, it is lost and the sculptor has to repeat each of the steps for any duplicates of the particular piece. The lost-wax indirect hollow cast, with its additional step in the early phase of the process, allows the bronze-casters to keep permanent clay molds of their finished models. By reusing these molds, the sculptors are not only able to make numerous copies of the original, but by altering facial or anatomical details in the wax layer, to produce individualized creations which mask the fact that they are products of the same molds. Recent scientific analyses using X-rays have shown that many bronze statues must have originated from the same molds, but with additional details in the wax final layer (Mattusch 2008). Hollow-casting, whether in its direct or indirect version, truly enabled bronze sculptors to cast larger figures with daring poses while at the same time economizing on material.
By taking a closer look at the dimensions of bronze sculptures, it becomes clearer why smiths were forced to develop different techniques to make the material match their artistic aspirations. For small figurines up to 0.3 m, solid casting is feasible both technically and financially. The large amount of bronze required for solid-cast sculptures and its resulting heavy weight (a solid-cast bull figurine of 0.09 m height weighs c. 120–150 g) were limiting factors when larger, more elaborate compositions had to be cast. Hammering thin metal sheets over a wooden core – the sphyrelaton technique – allowed the bronze-smiths to produce taller figures, like the Dreros Apollo, measuring 0.8 m. Although the hammered technique could (and must) have been used for taller sculptures, it is the hollow-casting that allowed the sculptors to cast (in parts which they later assembled) under- and over-life-sized statues (e.g. the Marathon Boy, Delphi Charioteer, god from Artemision; see Figure 13.5).

The potter’s kiln, as mentioned above, allows us to widen our perspective and to consider the technical equipment of a related craft, such as bronze-casting. A closer look at the depictions and remains of ceramic kilns and metallurgical furnaces highlights their differences. In antiquity, both were called kaminos, the generic name for most pyrotechnological structures, from the potter’s kiln to glass or bath furnaces. The Pent eskouphia plaques presented above are not only the best ancient evidence for recreating the appearance of an ancient potter’s kiln, they are also the culprits for lingering misinterpretations of the same scenes as depictions of metallurgical furnaces. The mine-like depictions in scenes of clay collection, the misinterpretation of the name of a kiln attendant from ‘Sodris’ into ‘sideros’ (iron) on a plaque in the Louvre (Figure 13.2), and the ancient fame of the Corinthian Bronze (Mattusch 2003), which still remains elusive for archaeologists, misled some scholars in the past to identify the entire series of the Pent eskouphia plaques with metal-working and ore-extraction (White 1984: 114).
The potter’s kiln, with its externally projecting stoking channel and its internal division, had nothing in common with the simple, internally- and externally-undifferentiated cylinder of a metal furnace. A simple juxtaposition of a potter’s kiln as depicted on a Pentekouphia pinax (Figure 13.2) and the metalworking furnace on the Foundry Painter’s cup (Figure 13.6) highlights these differences. The maximum temperature and the duration and control of firing are quite different: clay vessels need a maximum of 900°C, whereas metal alloys start melting above 1000°C. Higher temperatures dictated a smaller size for a metallurgical furnace, often less than 1 m in diameter. Firing is slow and gradual in a potter’s kiln (totaling three days, including the cooling), while the intense firing of a furnace lasts 4–6 hours. Charcoal fuel, despite its cost, is required.

13.4 The Sculptor’s Workshop

Sculptures can be made from almost all types of stone, but not all stone can produce the entire range of sculptured objects, from gemstones, to stone vessels, to reliefs, to free-standing sculptures of various heights. Hard stones such as
amethyst and cornelian lend themselves well to the carving of gemstones; others, such as the green lapis lacedaemonius, can be fashioned into vessels with mostly uncomplicated profiles. Among the softer stones, limestone, a sedimentary type of rock, and marble, a metamorphic type of rock (crystalline compact form of limestone), were the most versatile raw materials for producing reliefs, three-dimensional fully-carved sculptures, and containers to adorn cemeteries, temples, or houses. Both marble and limestone contain minerals whose hardness measures 2–3 on the Mohs scale (where 10 is reserved for diamond). A firm understanding of their relative softness makes us appreciate better the tools the Greeks used, and also how their toolkit, techniques, and resulting styles must have been quite different from those of cultures that used hard rocks (e.g. granite was used for Egyptian sculpture; granite contains hard minerals, such as quartz, whose hardness ranges c. 8 in the Mohs scale (Penny 1993; Rockwell 1993)).

Most marbles from the quarries in Athens and in the Cyclades were of whitish hue, but a few quarries had veins of colored marble, the best known being perhaps the greenish marble from Euboea (cipollino verde). Quarrying in Greece was done mostly above ground, as in Penteli in Attica, but some famous marble quarrying was done underground, as on Paros (Korres 2000). Some marbles were better for architectural blocks and others for sculpture. Subtle differentiation and intimate knowledge of a quarry and its variation of veins were part of the training of both the ancient mason and the sculptor.

The toolkit of the ancient sculptor consisted mainly of his mallet, with which he struck the point chisel, an assortment of other chisels (flat, tooth, roundel), and rasps (Palagia 2006b). Most of the tools have undergone little change over the centuries, and even the modern pneumatic ones differ from their ancient counterparts only insofar as their power source (compressed gas vs. human muscle). Iron was used for the metal component of the sculptor’s tools. Even nowadays on Tenos, the center for modern Greek traditional sculpture, ironsmiths specialize in producing high-quality tools for their neighbors, the master sculptors, underscoring once again the interdependence of crafts, as mentioned above.

The toolkit for working on marble must have been different from that used for working on granite, as the two types of stone require distinct techniques of quarrying and working (oblique blows on marble, vertical blows on granite). Intimate knowledge of the potential and limitations of the available raw materials should be taken into account when scholars envision an easy transfer of styles from one culture to another. The often-postulated Egyptian influence on Archaic Greek sculpture should perhaps be sought on the level of monumentality in sculpture (Boardman 2006), rather than on any transfer of technical expertise.

For efficient polishing, Greeks used emery (Mohs 8) from the rich deposits of the Cycladic island of Naxos. Then the statues were painted with bright colors. Extensive scientific analyses and computer reconstructions have convincingly argued that the austere white ancient Greek sculpture is a cultural
product of modern times and not a true reflection of ancient realities (Brinkmann and Wünsche 2007). Their preliminary results confirm beyond doubt that ancient cities were not only cities of image, as the title of an influential work stated (Bérard et al. 1989), but also cities of color.

The method of working on a three-dimensional statue until the Hellenistic period was to peel away a layer all around a statue, whereas from the Hellenistic onwards the sculptors proceeded with removing stone from the front to the back. Besides unfinished pieces, different information about the apprenticeship stages of a Roman sculptor can be gained by the group of apprentice practice pieces from Aphrodisias: single feet, double-sided pieces (with one foot on each side), and two right or left feet placed together on the same plinth (van Voorhis 1998, 2009). Many of the pieces still preserve measuring points, which guided the beginner sculptors in their training. Some further specialization is also detected in the sculptures from Aphrodisias, as some practiced on bodywork and others (presumably the more advanced) on headwork.

The workshop of a sculptor does not require permanent installations/ features like those of a potter (e.g. levigation basins or kilns). As the stone blocks receive most of their shaping at the quarry site (to detect any hidden defects, as well as to reduce weight, cost, and time of transportation), what remains to be completed at the sculptor’s workshop is the removal of the final few centimeters of stone and the highly intensive stage of polishing. Large quantities of marble chips are therefore what indicate the location of a workshop. A cluster of sculptors’ workshops (later occupied by terracotta workshops) is known from the ‘Industrial Quarter’ in the Athenian Agora (Young 1951). A concentration of unfinished sculptures, mostly reliefs and small statuettes in varying states of finish, have pinpointed the location of workshops on many sites, as found primarily on Delos (Jockey 2001). The ease of recycling marble pieces into smaller objects or even transforming them into plaster (in a lime kiln) makes it difficult to rely on unworked pieces for detecting sculptors’ workshops.

Public and private commissions often forced ancient (and modern) sculptors to travel away from their home city. Although the work of a master sculptor is usually a solitary endeavor, many master sculptors and other specialists often collaborated on public commissions of large scale, as the building accounts tell us. Detailed accounts of the sculpture and architecture of ancient Greece, their styles, locations, and artisans, are given elsewhere in this volume, and need not concern us here. At the same time, stone-working is perhaps the best documented of all ancient Greek crafts. The building accounts for the Erechtheion in Athens mention groups of laborers specializing in certain tasks (Randall 1953). Once the apprenticeship for one craft (and its relationship with others) was successfully completed, the talented artist could easily acquire the necessary skills in many other related crafts (e.g. Pheidias; Lapatin 1997),
becoming a multicraftsman, a *polytechnos*, in order to be able to envision and carry out (or direct) the execution of a masterpiece on his own. Division of labor and task specialization (either preexisting or adopted for a specific project) was a sine qua non condition, so that large crews could work effectively on large projects and finish temples in a period of 10–15 years. Younger (2004) has convincingly argued how repetitive scenes (such as the sandal-binding youth, horseback rider) on the Parthenon significantly reduced the time spent by having many smaller crews working simultaneously both on ground and on the monument, and assembling the finished blocks.

13.5 Workshops

Three scenes of craft workshops perhaps best summarize our brief visits to these places: (i) the Munich hydria, where pots are formed, shaped, and fired); (ii) the Foundry Painter’s cup (490–480 BC; Figure 13.6; Mattusch 1986; Neils 2000b), where bronzesmiths work at the furnace and assemble or polish cast statues); and (iii) a slab from a Roman sarcophagus from Ephesos (Figure 13.7; Smith 2009). We have already noted the shared pyrotechnological knowledge mastered by a potter and a bronzesmith. The similarities in the size of workforce also become noticeable. Since most crafts were family-based operations (males related by blood or marriage), it is not surprising that most multi-figure scenes show crews of similar size. Six workers on the Foundry Painter’s cup attend the furnace and work on two
statues of different sizes and styles. On the Roman sarcophagus a total of six sculptors work on statues at different stages. Similarly, on the Munich hydria, seven workmen are involved in the shaping, decorating, and firing of pots. As stated above, artisanal quarters in ancient Greek cities housed a number of crafts. Although notoriously known for the secrecy of their masters, these neighboring workshops were also characterized by a strong sense of interdependence and mutual influence. The shared forms of ceramic and metallic vessels need to be seen rather in this context of the artisans’ daily interactions and proximity in artisanal quarters, and not by degrading or upgrading one craft versus another.

13.6 Borrowings and Breakthroughs

The artisans’ quarters demonstrate a dynamic symbiosis of many craft communities (e.g. the Athenian Agora), which developed strategies of recycling other crafts’ leftovers, or perhaps gathered fuel in a more systematic way. The bronze-casters (and marble-sculptors for that matter) worked extensively with clay to produce an original smaller model and a later 1:1 scale working model, to make ceramic molds from this model, and when the lost-wax technique was discovered, to envelop and fill the wax models with clay (clay investment); therefore, the bronze-casters handled clay and had to be familiar with its qualities (Haynes 1992; Mattusch 1996a, 1996b; Mattusch et al. 2000; Hemingway 2004; Mattusch 2008). The same artisans also had briefly to use a low-temperature furnace (such as a potter’s kiln or at least a sizeable oven) to bake their molds, so that the wax would melt and leave the area empty to receive the bronze. For the establishments producing metal vessels, again clay molds were necessary for the forming of handles or other decoration. The metal tools to model stone for sculpture or architecture were invaluable to stone carvers, so the physical proximity of metalsmiths presented important advantages. Potters occasionally had to purchase or produce in the workshop lead clamps to fix broken pieces of valuable vessels. A technological koine is further noted in the decorative motifs that potters and metalsmiths shared with one another, as with weavers, or in the shared forms that craftsmen working in clay and metal produced. The correct rendering of tools and equipment of various crafts (bronze casters, shoemakers, marble-carvers) on decorated vases strongly suggests that the workshops in the quarters were welcoming places. Although intimate knowledge of a craft was shared cautiously (then as now), craftsmen of different trades were in daily contact with each other in the streets of their quarters,
and despite their busy lives could have cast furtive looks into the workshops and activities of their neighbors.

In terms of technology, all crafts, from pottery, to bronze-making, to ivory-carving, are very stable, and little to no radical breakthroughs are noticed from the Bronze Age to the end of Classical times. The major technical steps were always the same, yet the craftsmen refined the traditional techniques with small details (the clay paste, the wheel, the control of firing, the lost-wax bronze-casting, a different type of chisel, the anvil, the tongue, the tubes) – tools mostly the same as those of a 20th c. traditional potter.

Despite this apparent slow technological progress, ancient Greeks loved to celebrate significant moments of innovation, or invention, no matter how big or small the break with the preexisting tradition. Ancient Greeks celebrated the ‘protops euretes’, the first inventor (a figure more imaginary than real), of a technique (Kleingunther 1974). Corinth and its greater region have been credited with many technological breakthroughs, including in architecture, pottery, and painting; and 5th c. BC Athens was celebrated as the birthplace of the potter’s wheel (Kritias, Elegies 1.12–13). But these details lie more in the realm of poetic fiction and civic/regional exaggerated pride than in reality. In an interesting period, with a fervor for experimentation in vase-painting (c. 530–510 BC), the Athenian vase-painters tried coral-red, white-ground, and the ‘Six technique’, but these were all short-lived (Cohen 2006; Lapatin 2008). Only the simple inversion of the established black-figure technique to red-figure grew roots. When unique projects or advances were accomplished in architecture, sculpture, or painting, their creators wrote treatises on them (e.g. on the Parthenon by Iktinos and Kallikrates; the Kanon by Polykleitos; De Architectura by Vitruvius), but these again were celebrations of achieved mastery rather than basic craft handbooks and neither aimed to nor did incite younger generations to replicate these projects. Paradoxically perhaps for the archaeologists, nothing remains in the archaeological or literary record about a potter’s treatise, a classical counterpart of Picolpasso’s three-volume treatise about pottery-making (Li Tre Libre Dell’Arte Del Vasaio), written in the 16th c. AD.

13.7 Social Standing and Appreciation

The social standing and appreciation of the craftsman (or better, lack thereof) has been well-researched in the literature. The topoi remain passages from Aristotle, Plato, and occasionally Plutarch, who seem to have high appreciation of the artisans’ products but hold their producers in very low esteem (Burford 1972; Greene 2008). The Greek words techne (way to solve a problem, whether medical, architectural, or technical) and banausoi are the
best descriptive terms that survive in literature. Although the philosophers did not mention a single craftsman by name (with the exception of Pheidias), we must look to craft training as providing a solid model of perseverance, gradual skill learning, and ultimate test of capacity: either you can do it or not! There is a more general absence of ancient names, especially in the area of pottery production (apart from the potter’s and vase-painter’s own signatures), and there are no craft handbooks. As mentioned above, there are only treatises of unique, successfully completed projects, or major breakthroughs in technique. Indeed, the Parthenon was the culmination of the intellectual and the political, but Pheidias should not be regarded as a role model (Plut. Vit. Per. 2).

The late 6th and 5th c. BC showed a different stance towards the crafts: Herodotos claims that Corinthians held their artisans in high esteem, and Athenian craftsmen offered high-priced dedications on the Acropolis, celebrating their mastery and reputation, even if some of them could not enjoy full-scale citizen rights (as their slave or metic status would not allow it). The building records of major construction projects on the Acropolis, like the Erechtheion, list the names of artisans and assistants, and their work was a legacy for all the Athenians (citizens, metics, and slaves) to admire (Randall 1953). Combining the philosophers’ etic way of addressing the artisans’ world and the artisans’ emic ways of portraying themselves during the 7th–5th c. BC does not necessarily result in a true understanding of the social status of the artisans (Verbanck-Pierard 2008). Social status itself is both assigned and assumed. On the part of the artisans, there is certainly a pride in their craft, as evidenced by their few, but present, signatures and their dedications in the material they worked or in other material in sanctuaries and in tombs. In the 4th c., after a series of wars, the artisans’ pride and their contribution to the welfare of their polis may have subsided, at which point the philosophers’ comments became more intense and numerous, and dominated the discussion of the artisan’s status. Most craft celebrations of Greek artisans took place during their lifetimes, in sanctuaries or agoras. Roman craftsmen, by contrast, very often chose their final resting place to proudly display their craft for eternity (Zimmer 1982b).

FURTHER READING

The best introductions to workshop organization and craft technology for a variety of ancient Greek (and Roman) crafts are the recently-edited volumes of Oleson (2008) and Ling (2000). Depictions of craftsmen are well-served in scholarship: see Hadjidimitriou (2005), Papadopoulos (2003), Hasaki (2002), Jockey (1998), Smith (2009), Vidale (2002), Zimmer (1982a, 1990), Ziomecki (1975), and Williams (2009b). Debasing textual references to banausoi are discussed in Müller (1974),
Neesen (1989), and Roochnik (1996). Other significant contributions to the study of ancient technology from Prehistoric to Byzantine times include Evely (2002) and Humphrey et al. (1998). Burford (1972), Roebuck (1969), and White (1984) represent the first generation of monographs on ancient technology and the status of artisans. All these studies expand on the pioneering study of the 19th c., Blümner (1885–1887). The ancient references to ancient artists are also presented in Overbeck (1858 [1959]) and, in a shorter version and in English translation, in Pollitt (1990).

For style, technique, trade, and connoisseurship in Greek pottery, see Boardman (2001). Other standard references are Noble (1988), Sparkes (1991), Scheibler (1986), and Cuomo Di Caprio (1984). The step-by-step shaping of most Athenian vessels and many other technical details are superbly illustrated in Schreiber (1999). A series of conferences on less popular decorative techniques for Athenian vases (i.e. coral red, ‘Six technique’) has brought to light interesting aspects of technique and distribution; see Cohen (2006), Lapatin (2008), and Tsingarida (2009). Rice’s handbook on pottery analysis (1987) provides a solid background for the more technical aspects of pottery-making across cultures and periods.

For bronze-casting techniques, the works by Haynes (1992) and Mattusch (1996a, 2008) are standard references. The conference volumes From the Parts to the Whole (Mattusch et al. 2000) and Fire of Hephaistos (Mattusch 1996b) emphasize technical aspects of ancient bronzes. Hemingway (2004) also sheds more light on technical issues and new methods that display hidden clues on ancient repairs.

For sculpture techniques and the locations of marble workshops, see more recently Palagia (2006a), Rockwell (1993, with earlier bibliography), and Nolte (2005). Stewart (1990) on Greek sculpture combines well an art-historical survey with political and social-historical aspects of Greek sculpture. He also provides a list of ancient testimonia in translation. For marble quarries, especially on Paros, see Schilardi (2000). Other crafts not covered in this essay include ivory-working (Lapatin 2001) and woodworking. Ulrich’s (2007) monograph on the woodworking in the Roman period touches on issues relevant for all of Greco-Roman antiquity. On gem-cutting, see Boardman (2001b) and Plantzos (1999: 38–41).

Craft apprenticeship (mainly in the textile industry) is documented in Hellenistic and Roman papyri from Egypt (Bergamasco 1995). The apprenticeship contracts outline in detail the duration of craft apprenticeship, the duties of the master and the apprentice, wages, and even the days of vacation per year.