CHAPTER 21

DEATH AND BURIAL

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Neolithic Greece

In the Mesolithic period, several adults and infants were buried near the entrance of the Franchthi cave in the Argolid (Jacobsen and Cullen 1981). Two of the adults, a male and a female, had apparently been cremated (Cullen 1995). Clearly, funeral practices were already well developed before the start of the Neolithic period. As the population increased with the growth of settlements, we would expect more graves. However, the number of excavated Neolithic burials can be counted in the hundreds, whereas tens of thousands of people lived and died in Greece between 7000 and 3000 BC. Obviously we will never find everyone, but the Neolithic dead do seem unusually elusive.

Intramural burial within settlements was not common for adults. Most of the cases that have been recorded were infants or young children (Cavanagh and Mee 1998, 7; Perlès 2001, 276–79). The situation is different in caves that were occupied at this time, such as Franchthi and Alepotrypa in Laconia (Papathanassopoulos 1996, 175–77). The remains of adults and children have been found at both of these sites, but few of the skeletons were articulated. Although some may have been disturbed, it is clear that secondary burial was a regular practice. At Alepotrypa, two ossuaries have been excavated; each contained a mass of bones. Particular attention had been paid to the skulls, which were sometimes surrounded by a circle of stones. The darkness of the cave would undoubtedly have heightened the psychological impact of these rituals.

Secondary burials have occasionally been reported in settlements (Cavanagh and Mee 1998, 9; Perlès 2001, 279–80). Under one of the houses at Prodromos in Thessaly were eleven skulls. However, most of the dead must have been buried elsewhere. An Early Neolithic cemetery was discovered a short distance from

Souphli, another Thessalian site (Gallis 1982; Perlès 2001, 274–76). The dead had been cremated on pyres and included adults and juveniles. Once the body had burned, the remains were removed from the pyre while still hot and buried in a pit. Some of the pottery with the burials was scorched and had obviously been placed on the pyre. Cremation is a more elaborate rite that requires a considerable amount of fuel, so it is significant that no distinction seems to have been made regarding the age or gender of the deceased.

Although Neolithic cremations have been found at a number of other sites, inhumation was probably the most common practice (Cavanagh and Mee 1998, 7–9). So where were most of the dead buried? Excavators would almost certainly miss a cemetery that was some distance from a settlement, yet it is remarkable that more accidental discoveries have not been made, particularly in Thessaly, which has hundreds of Neolithic sites. The explanation may be that most graves were quite shallow and have consequently been destroyed or disturbed by later activities.

This makes it sound as though death was treated rather casually, perhaps because it was such a common occurrence at a time when life expectancy was so short. Children were especially susceptible, and most would have died before they reached adulthood. Neolithic society has also been perceived as relatively egalitarian, which meant that families did not use the funeral as an opportunity to stress status distinctions, and in any case they could not afford a lavish ceremony. Yet some communities did have complex ritual practices that they observed in the case of both children and adults, which may well reflect a more widely held set of beliefs. Moreover, there is evidence of inequality in the Late Neolithic period, if not earlier. Neolithic funerals were probably not as simple as they seem (Cavanagh and Mee 1998, 10–11).

Early Bronze Age

In the Final Neolithic cemetery at Kephala on Keos, the graves were built of stone (Coleman 1977). As a result, the dead had a much more visible presence, and this new trend was soon taken up elsewhere in the Cyclades. Early Bronze Age cemeteries have been excavated on most of the islands (Doumas 1977; Barber 1987, 74–85). Generally they consist of 15–20 graves, though some were much larger, in particular Chalandriani on Syros, with more than 600. The typical grave is a cist, a rectangular or trapezoidal stone-lined pit covered by slabs. Because the graves were usually less than a meter in length, the dead were buried in a contracted position with their legs bent up. It is possible that this was symbolic and not just a practical necessity. Quite often graves were used again, presumably for another family member. The remains of previous burials would then be moved aside to make room, though the skull was usually left undisturbed. In some cists, an extra floor was added so that the upper chamber could be used for burials and the lower chamber as an ossuary.

Many graves produced no finds, though we must bear in mind that perishable items may have been left with the dead. No doubt they wore clothes or a shroud and could have been given items of food that have not survived. Pottery is the most common type of grave good that is present, particularly bowls, cups, and jugs, which suggests the belief that the dead needed provisions for the afterlife. If the obsidian blades were razors, they were probably also expected to look well groomed. Wealth is sometimes emphasized with metal or marble vessels, weapons, jewelry, and figurines.

Once buried, these items had been taken out of circulation in what was clearly intended as a reminder of the status that the deceased had enjoyed in life and which was expected to continue even after death. This display of wealth no doubt promoted the position of the family as well. The marble figurines are particularly impressive, and their artistic appeal is unfortunately the reason so many Early Cycladic graves have been looted. They underline the religious dimension of the rituals that were performed at the funeral, and the discovery of stone platforms in some cemeteries is an indication that ceremonies may also have been held at other times.

In Greece, most of the Early Bronze Age cemeteries are concentrated in the eastern mainland, in the Argolid, Corinthia, Attica, Boeotia, and on Euboea (Cavanagh and Mee 1998, 15–21). At Tsepi in Attica is a cemetery of rectangular built graves that were laid out in rows (Pantelidou-Gofa 2005). Each grave was carefully outlined with a border of stones. The sides of the grave were lined with rubble or slabs, a row of slabs formed the roof, and one end had a narrow entrance. The graves were used repeatedly. The latest burial had generally been left just inside the entrance. At the back of the chamber was a mass of stacked bones, though more care was taken with the skulls, which were sometimes lined up on one side. This is reminiscent of the way that earlier burials were treated in the islands, and much of the pottery, though locally made, is Cycladic in style.

A number of cemeteries contained chamber tombs (Cavanagh and Mee 1998, 17). At Manika on Euboea, the entrance to such tombs was a vertical shaft, off of which opened the chamber, which could be rectangular, trapezoidal, or circular (Sampson 1985, 1988). The chamber was carefully blocked off by slabs or stones. The dead had usually been buried in a contracted position despite the fact that the chambers were often more than two meters in diameter. Thus, the size of the tomb did not necessarily dictate how the body would be laid out. Earlier burials were pushed to one side, and in some cases the bones had apparently been removed and put in an ossuary. The quantity and quality of the finds varies, presumably because of differences in status. A connection with the Cyclades is evident, and the presence of marble figurines suggests that these shared tastes reflect similar beliefs.

On Lefkas in western Greece, the dead were cremated, and the grave goods were also placed on the pyre (Dörpfeld 1927). Once this had burned down, the remains and some of the grave goods were collected and put into a pithos, which was sealed with a slab. A circular stone platform was then built around the pithos, and this

also covered the pyre. The platform was in turn covered by a mound of earth and stones, which formed a tumulus. In many of the tumuli, additional graves were later inserted in the stone platform. This marks the start of a vogue for circular tombs in western Greece that continues in the Middle Bronze Age, though elsewhere on the mainland there is more of a break (Cavanagh and Mee 1998, 17).

Different regional traditions also developed on Crete. The tombs in the south of the island were circular stone tholoi (Branigan 1993). The first tholoi were constructed in EM I, and this was still the most common tomb type in the Protopalatial period. Around seventy have been discovered in cemeteries of one, two, or three tombs. At sites with more than one tomb, their use overlaps. They were built a short distance from the settlement, often within 100 meters or so (Branigan 1998). The dead were nearby, but the tombs were oriented so that the entrance faced away from the settlement. Consequently, they could not see their homes and would be less inclined to return. The fact that the tomb entrances were carefully blocked highlights this desire to keep the dead in their place. Nevertheless, because of the size and solid construction of the tombs, they were a very visible and permanent presence. Many of them remained in use for centuries and would have been a powerful symbol of the entitlement that a community could claim to land and other key resources (Murphy 1998).

A tholos has a circular wall made up of a rubble core faced with larger blocks of stone, which can be more than two meters thick in the case of the largest tombs, which have a diameter of ten meters or more (Branigan 1998). There has been considerable speculation about the type of roof. Because the walls lean in and masses of fallen stone have sometimes been found in the chamber, the obvious solution is a stone vault. However, the walls were not buttressed in any way, so they could not have supported the weight of a stone roof. Mud brick is an alternative, though this would be identifiable and has not been reported from any of the excavated tombs. Thatch is another possibility, but no consensus exists as yet. The entrance was almost always on the east side of the tomb, so sunrise may have had a special significance. A number of tholoi also had annexes in front of the entrance, which had been added later.

Because of the length of time the tholoi remained in use and the fact that most have been looted, it is not easy to reconstruct the funeral rites (Branigan 1993). The dead were apparently laid out on the floor of the tomb with personal possessions, which could include weapons, tools, jewelry, seal stones, and pottery. Food and drink were provided, some of which may have been consumed by the mourners at the funeral. The number of cups suggests that a toast was drunk or libations poured before the entrance of the tomb was sealed. Few skeletons have been found in situ, and it is evident that, once the body had decomposed, the bones were swept aside. It seems that the tombs were periodically cleaned out and purified. The bones would then be transferred to one of the annexes, which were used as ossuaries. When the remains of earlier burials were moved, no doubt a ceremony marked this final stage of the journey. The presence of stone platforms suggests that the tombs may have been a focus for cult and ritual activity at other times as well, which implies that the

dead were venerated if not worshipped. As far as we can tell, the entire community was buried in these tombs. There was certainly no discrimination on the basis of age or gender. Some tombs were probably reserved for particular groups of families, which would explain why settlements had two or three tholoi, but differences in status were not emphasized.

At Ayia Photia in eastern Crete is a cemetery with more than 250 EM I/II tombs. Most have a vertical shaft and a rectangular or oval chamber sealed by a stone slab (Davaras and Betancourt 2004). Similar tombs appear in the Cyclades, and much of the pottery and metalwork is Cycladic in style. The possibility that this was a case of colonization rather than acculturation or close contact has therefore been raised. There were also rectangular stone-built tombs in the northern and eastern parts of the island (Soles 1992; Vavouranakis 2007). In some respects they resemble houses, but it is questionable whether they were conceived as a home away from home for the dead. The cemetery on the island of Mochlos was located so that the tombs would be visible from the sea as ships approached, but they cannot be seen from the settlement. Approximately thirty tombs have been excavated, built up against the rock face in such a way that they seem like part of the landscape. A processional path winds up through the cemetery to the most elaborate tombs I/II/III and IV/V/VI. In front of IV/V/VI were a paved court and a platform, possibly an altar. Although the tombs have been disturbed, they were evidently used for primary burials. In due course, the bones were moved to another compartment, where the skulls were carefully stacked together. Much of the jewelry that was buried in the tombs is of gold or silver. Many superb stone vessels have also been found. The finest objects were not found exclusively in the largest tombs, though they were concentrated in I/II/III and IV/V/VI. Status must have been a more contentious issue at Mochlos and was certainly the case at Malia, where one of the tombs is enormous. Known as the Chrysolakkos, or gold pit (from the spectacular finds, most of which were looted), the tomb measures approximately forty by thirty meters, and the interior was divided into rows of burial compartments. Built at the start of the Protopalatial period, at around the same time as the palace at Malia, it was surely reserved for the elite (Soles 1992, 163–71).

The burial record is not always an accurate barometer of social change, but the political upheavals on Crete clearly had an impact. The cemetery at Archanes in the north of the island is unusual in that it contains tholoi and rectangular built tombs (Sakellarakis and Sapouna-Sakellaraki 1997). This fusion of two distinct architectural styles integrated different traditions and continued in the Middle Minoan period, when the cemetery was expanded. Tomb B, a two-story structure with a tholos enclosed on three sides by annexes, is particularly impressive. Many of the dead were buried in clay jars or terracotta larnakes. It is unclear whether this was an indication of higher status or reflects a greater emphasis on individuality, which is evident from the choice of personal items in these tombs. The seal stones especially were a mark of identity. It is significant that the level of activity at Archanes increased in MM IA, just before the old palaces were constructed, a time when the competition for power must have intensified.

Middle Bronze Age

In Greece, the situation was very different. Many of the Early Helladic cemeteries went out of use, and burial in simple pit or cist graves became the rule (Cavanagh and Mee 1998, 23–35). The most impressive Middle Helladic tombs were tumuli, which can be as much as 25 meters in diameter. However, even though a central grave sometimes occurs, which suggests a recognition of higher status, the finds are generally rather modest, especially in comparison with the Early Helladic tumuli on Lefkas (Boyd 2002). In the pit and cist graves, this impression of austerity is even more apparent. Less than 30% of the two hundred Middle Helladic burials at Lerna had any recognizable grave goods, and this figure is fairly typical. Some settlements did have cemeteries with clusters of graves in which members of the same family had presumably been buried. Intramural burial was also very common, though the graves were often in a part of the settlement that had been abandoned or was not occupied at the time. It was usually children who were buried under the houses.

As an example of a Middle Helladic cemetery, one may look at Kouphovouno in Laconia, where sixteen graves have been excavated, as well as the remains of skeletons that had been disturbed (Cavanagh and Lagia in press). Some of the graves were pits that were often edged with stones that had supported a roof made of perishable material. There were also cists constructed of upright slabs (figure 21.1). The dead had usually been buried on their sides in a contracted position. Only a few had grave goods. The remains of twenty-seven individuals have been identified, adults and children, males and females (table 21.1).

The greatest likelihood of death was in infancy/early childhood and late adolescence/young adulthood. The mortality rate between birth and five years was very high in these communities. At Lerna, the figure is almost 50%, so parents could expect that half of their children would die before they were five. The reason for this was nutritional deficiency combined with childhood diseases. The second phase of increased mortality in late adolescence/young adulthood is usually due to the risks of childbirth, but women of this age are underrepresented at Kouphovouno, and they may have been buried in another part of the cemetery. A number of the males in this group had suffered serious injuries; one had somehow been cut in two. Some graves contained the remains of adults and infants. The natural assumption is that a mother and infant were buried together, but in one case the adult was male, and DNA analysis has shown that the two individuals were related.

The people of Kouphovouno were not very healthy (Cavanagh and Lagia in press). Study of the skeletons has shown that, as children, they were malnourished and suffered from diseases, in particular rickets, scurvy, measles, and smallpox. Hard work had caused degenerative changes in the adult skeletons of both sexes. Arthritis and osteoporosis were also common. Stable isotope analysis of the carbon and nitrogen in bone samples from Kouphovouno indicates a diet that mainly consisted of plant foods, such as wheat, barley, and fruits. Some animal protein was consumed, either as meat or dairy products, but not in significant quantities.

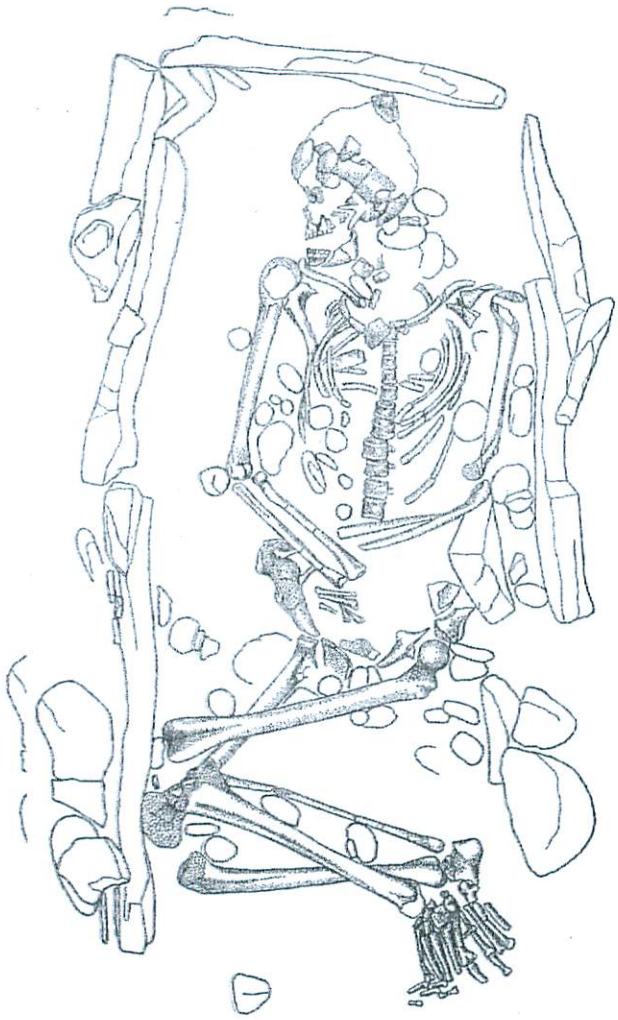

Figure 21.1. Cist grave at Kouphovouno (courtesy of the author).

Table 21.1. Middle Helladic cemetery at Kouphovouno in Laconia

Age Group	Number of Individuals	Male	Female	Indeterminate Sex
Infants (0–1 yrs.)	5			5
Young children (2–5 yrs.)	3			3
Older children (6–12 yrs.)	1			1
Adolescents (13–19 yrs.)	5	3	1	1
Young adults (20–34 yrs.)	3	3		
Middle-aged adults (35–49 yrs.)	4	3	1	
Old adults (50+ yrs.)	2		2	
Adults (20+ yrs.)	4	1		3
Total	27	10	4	13

Source: Courtesy of the author.

For many Middle Helladic communities, life must have been fairly grim, and it is difficult to escape the conclusion that this was a period when most people were desperately poor. However, there were exceptions. Kolonna on Aigina was a fortified settlement that had built up a network of trade contacts and was consequently quite prosperous. Just in front of the main gate in the fortifications, a man was buried with a sword, a dagger, a spear, a helmet, and a gold diadem (Kilian-Dirlmeier 1997). He was clearly an exceptional individual who was commemorated as a warrior, perhaps because of his military prowess. He also set a precedent for the spectacularly rich burials in the shaft graves at Mycenae.

Late Bronze Age

Although the two shaft grave circles at Mycenae were in use before the end of the Middle Helladic period, they nonetheless mark the start of a new era. Circle A is prominently positioned just inside the Lion Gate, but this arrangement dates from LH IIIB, when the fortifications were extended. At the same time, the grave circle was carefully restored, and the original enclosure wall was replaced. This was done three centuries or so after the final burial had taken place and indicates a reverence for the dead that suggests that they were worshipped as the founders of the royal dynasty, whatever their relationship with the later rulers of Mycenae may in fact have been.

There were six shaft graves in Circle A, the largest of which measured 4.50 by 6.40 meters and was 4.00 meters deep (Karo 1930–1933; Dickinson 1977, 46–50). The graves consisted of a rectangular shaft cut through the earth and rock, with a ledge at the lower end to support the roof. Nineteen people had been buried in the graves: eight men, nine women, and two children. The men had an extraordinary array of weapons, an arsenal of finely crafted swords, daggers, spears, and knives. They are depicted as heroic warriors and hunters on some of the gold rings from the graves. Men and women were covered in jewelry, in particular gold discs that were sewn on their clothes or shrouds. Some of the men wore gold funeral masks. The dead were also provided with gold and silver cups and goblets, presumably so that they could dine in style in the underworld.

Grave Circle B was only a short distance from the citadel but had evidently been forgotten by the LH IIIB period (Mylonas 1973; Dickinson 1977, 40–46). The fourteen shaft graves were generally not as large as those in Circle A, and there were also eleven cist and pit graves. A built grave, tomb Rho, was added later. It was not possible to determine the age and sex of all of the burials, but adults outnumber children 24:8, and there are also three times as many men as women. The maximum number of burials was four in grave Gamma: three men and a woman. One of the men had been buried first, followed by the woman. Their skeletons were subsequently moved aside for the burial of the man in the center. Finally, another man was laid across

one end of the grave. After each burial, the roof was replaced and sealed with clay. The shaft was then filled with earth, and the grave was marked by a low mound and sometimes a carved gravestone.

Men, women, and children were buried in Grave Circle B with an impressive range of grave goods, but many of the dead had only pottery. The Circle A burials were generally much richer (Laffineur 1989; Graziadio 1991). However, it is important to note that, although the two circles coexisted for a time, Circle B was in use first. Thus, it could be argued that what we see is an escalation in conspicuous consumption because the wealth that was taken out of circulation when it was deposited in these graves had effectively been destroyed. The reason for this extravagance was a desire for prestige and consequently status (Voutsaki 1995). This was evidently a period of political instability, and funerals were an occasion for legitimizing the transfer of power and rights of succession. Those buried in the grave circles were clearly an élite who had set themselves apart. Yet there must also have been divisions within this group, which would explain why Circle A was established.

The shaft graves were essentially enlarged pit graves and could be viewed as an example of the ostentation that is such a feature of this period. However, their size also facilitated a move to collective burial, which is equally true of tholos and chamber tombs (Cavanagh and Mee 1998, 41–49). Tholos tombs originated in Messenia at the end of the Middle Helladic period (Voutsaki 1998). These new types of tomb were designed to be reopened periodically for the burial of individuals who were no doubt related in some way, so this practice places a much greater emphasis on hereditary status. The narrow *dromos* leads to the entrance of the tomb. The circular burial chamber has a corbeled stone vault (Pelon 1976). Unlike Minoan tholoi, the Mycenaean tombs were cut into the bedrock, so that the vault was buttressed, and they were covered by an earth mound.

Soon there were tholos tombs in the Argolid and Laconia, as well as Messenia. In LH II, seven were constructed at Mycenae, where they replaced shaft graves as the high-status option. It seems quite likely that some were royal tombs, though tholoi were probably not reserved just for rulers. Most had been robbed, but a few were still intact or had pits in the chamber floor that had not been opened. This was the case at Dendra in the Argolid and Vapheio in Laconia, for example. The character and quality of the finds emphasizes how important the funeral had become for these image-conscious individuals.

Chamber tombs have a similar layout but were rock cut rather than stone built (Cavanagh and Mee 1998, 54–55). Some have circular chambers like tholos tombs or are rectangular. At Prosymna in the Argolid, the size of the chamber ranges from 5–30 square meters (Blegen 1937), though one of the tombs at Pellana in Laconia has a chamber more than 10 meters in diameter, as large as a tholos. It is questionable whether there were any rigid rules about who could be buried in a tholos or chamber tomb in LH I–II (Voutsaki 1995). The Minoans also had rock-cut chamber tombs (Pini 1968), which the Mycenaeans may well have seen and adapted. The distinctive mainland style of tomb is then found at Knossos in LM II–IIIA, when it is believed that the palace was under Mycenaean control. The warriors who were

buried in these tombs have quite naturally been identified as Mycenaeans, but this assumption has been questioned (Preston 1999, 2004). It is equally possible that they were Minoans whose way of life had been influenced by the warrior ethos, which was prevalent in Greece at this time. There may be a more subtle explanation for changes in the burial record than an alteration in the ethnic makeup of a community.

Although LH III is often regarded as a period of greater uniformity (and it is true that there is less experimentation during this time), regional differences are apparent (Cavanagh and Mee 1998, 77–79). For example, Messenia had few chamber tomb cemeteries, unlike in Boeotia, where tholos tombs were a rarity. Variation is also evident at a more local level, possibly because communities wished to maintain their traditions and consequently an independent identity as the Mycenaean palaces grew more powerful and influential. Some rulers may well have imposed restrictions.

Mycenae and Tiryns were the only sites in the Argolid where tholos tombs were constructed in LH IIIA–B. Moreover, the tombs at Mycenae were the magnificent Treasury of Atreus and the Tomb of Clytemnaestra. It would have taken around twenty thousand man days to build the Treasury of Atreus (Cavanagh and Mee 1999). The tomb is approached down a *dromos* 36 meters in length, which is lined with ashlar masonry. The façade was decorated with green and red marble columns. Above the entrance, which was sealed by double doors sheathed in bronze, is a lintel block that weighs approximately 120 tons. The chamber is 14.5 meters in diameter and 13.6 meters high, with thirty-three smoothly finished courses of masonry (Pelon 1976). The ruler who built this tomb was no doubt buried in the side chamber.

Chamber tombs were much more common in LH III and must have been used by a wider cross-section of society (Cavanagh and Mee 1998, 65–79). They were likely family tombs, but at those sites where the skeletal remains have been properly studied, children were clearly underrepresented. Moreover, they had often been buried in a niche in front of the entrance rather than in the chamber or were given separate tombs. The fact that children were treated differently does not imply a lack of concern or respect. Parents would have grieved when a child died, but with the mortality rate hovering around 50% for those under the age of ten, the death of a child was a frequent occurrence. To cope psychologically with their loss, parents may not have viewed children as full-fledged members of society who needed to be ritually reunited with their ancestors. Of course, some children were buried alongside adults, and it is evident that the conventions that governed behavior were very flexible. Curiously, men also outnumber women in Mycenaean tombs. Although it is true that female skeletons are not as robust and would therefore be more likely to have disintegrated, this does not fully account for the discrepancy. There seems to have been a gender bias, which may be linked with the dependent status of most of the women as wives and daughters in Mycenaean society (Mee 1998).

We can reconstruct the ceremonies at the graveside from the hundreds of excavated chamber tombs, but the first part of the funeral took place away from the cemetery, probably in or outside the home of the person who had died. Terracotta

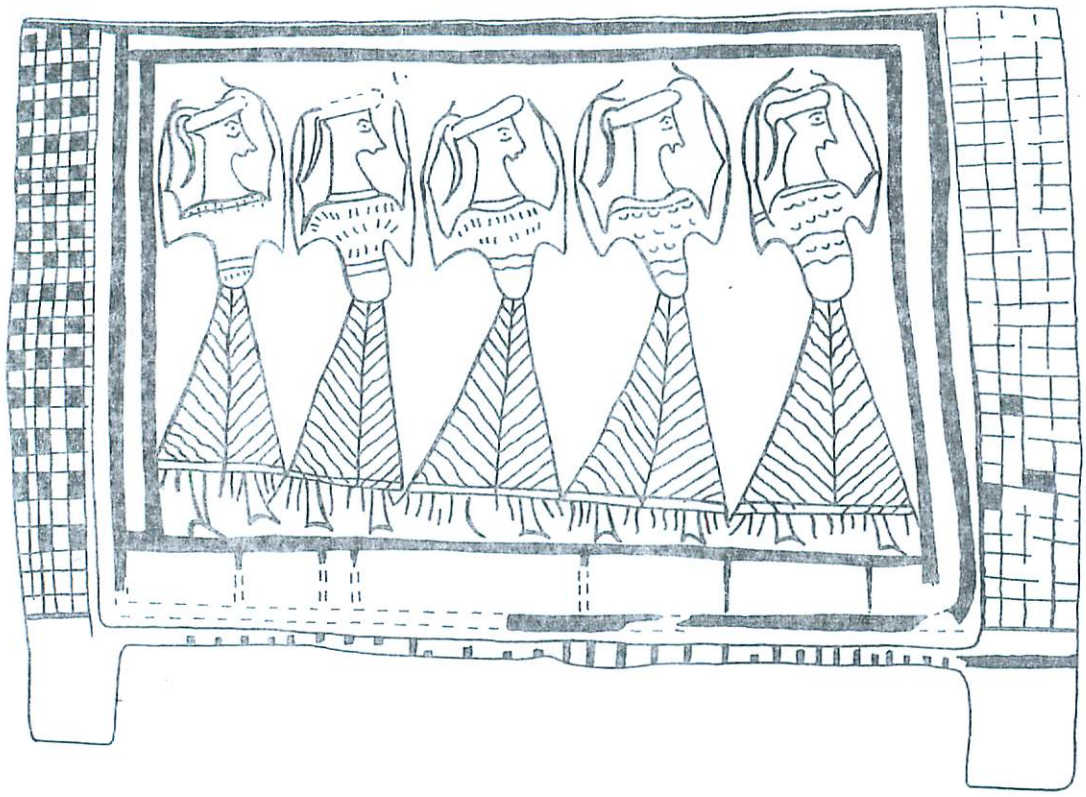

Figure 21.2. Tanagra larnax (after Cavanagh and Mee 1995, 48, figure 1).

larnakes from Tanagra in Boeotia depict processions of women who raise their hands to their heads in a gesture that clearly expresses their grief (Cavanagh and Mee 1995; Immerwahr 1995) (figure 21.2). Their dress suggests that they led the mourners when the corpse was laid out and the community members came to pay their respects. Other women with shaved heads and lacerated faces were presumably close relatives. In one highly emotional scene, they lower the body of a child into a larnax. Men occasionally appear on the larnakes but do not seem to have been as closely involved, perhaps because there were taboos that restricted how they could act.

The journey to the cemetery began a process of separation that took the dead physically and symbolically away from family and friends (Cavanagh and Mee 1998, 71–76, 103–20; Gallou 2005, 82–132). Once the body had been brought into the tomb, it was laid out, normally in an extended position, on the floor or a bench (Wace 1932). Terracotta larnakes and wooden coffins were occasionally used. The pottery provided often includes jars of perfumed oil, a tradition that would continue for centuries. The oil was a luxury and also signified purity. Vessels with food and drink may be the residue of a funeral feast, though it was evidently expected that the dead would need supplies for the afterlife. They were given jewelry and no doubt wore their finest clothes as well. There is less of an emphasis on weaponry, perhaps because it was now believed that bronze should be kept in circulation. Terracotta female figurines, found with children, probably offered protection. The entrance was then carefully blocked with stone, a toast was drunk, and the cups were shattered against the wall. Finally, the *dromos* was backfilled with earth. When the next

funeral took place, the *dromos* and the entrance would be unblocked and the process repeated. However, the time would come when the chamber offered no more room. At this point, earlier burials were moved to one side, or the bones were collected and placed in a pit.

This practice has often been seen as rather cavalier, and a contrast has been drawn between the care taken when the dead were first buried and their later treatment. However, tombs have been excavated in which none of the skeletons was undisturbed. It seems likely that the chamber had been reopened for a ceremony that involved the rearrangement of the last burial. Ceremonies of this type were probably a regular occurrence and marked the final stage in the journey that the dead had undertaken. Like many societies, the Mycenaeans evidently believed in a liminal phase between life and death. This ended when the body had decomposed and the spirit was freed. Ceremonies ensured that the dead were placated and would not cause trouble. They also gave the bereaved time to adjust to their loss.

After the destruction of the palaces at the end of the LH IIIB period, no more major tholos tombs and fewer chamber tombs were built (Cavanagh and Mee 1998, 89–97; Dickinson 2006, 178–83). Sometimes tombs that had gone out of use were cleared and reused, presumably by a different group. Some new chamber tombs appeared, notably at Perati in Attica, but they were small and not as well constructed (Iakovidis 1969). This is not a sign of poverty, however, because some of the Perati tombs were quite rich. Nevertheless, many of the tombs held only one or two skeletons, which suggests a change of beliefs. It was no longer the custom that generations of the same family would be buried together, which anticipates the move to individual burial in the Early Iron Age. The funeral ceremony may also have been curtailed, which could explain the introduction of cremation. The first Mycenaean cremations were at Müskebi in western Anatolia, and the rite may have spread from there. The puzzle is that, at Perati, for example, we find cremations and inhumations in the same tomb. Thus, it seems unlikely that those who were cremated came from a different ethnic group. Changes such as the move to individual burial (Lewartowski 2000) and the adoption of cremation were once used as evidence of population movements in the twelfth and eleventh centuries. What they actually reflect is the sense of insecurity that had undermined confidence in the social order and the traditions that underpinned this.

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CHAPTER 23

WEAPONS AND WARFARE

IOANNIS GEORGANAS

SINCE the dawn of human history, conflict and warfare have been an integral part of life. The earliest concrete evidence for warfare in the Aegean comes from the Early Bronze Age, as the large number of daggers on Crete indicates. However, it is with the rise of the Mycenaeans on mainland Greece that a warlike ethos becomes more prominent, as is evident by the numerous and spectacular weapons retrieved from the Shaft Graves at Mycenae, as well as the numerous representations of warriors and combat scenes. Thanks to Homer's *Iliad* and *Odyssey*, the Aegean Bronze Age has always been perceived as a time when warrior-heroes roamed the land and engaged in military campaigns in Greece, the Aegean, and beyond.

This chapter provides a concise history of weapons and warfare in the Aegean during the Bronze Age. Aspects to be covered are offensive equipment, defensive equipment, and chariotry.

OFFENSIVE EQUIPMENT

Included under this heading are daggers and swords, spears, bows, and slings. Each class of weapons is examined separately in rough chronological order from the Early Bronze to the Late Bronze Age.

Daggers and Swords

The most characteristic weapon of the Early Bronze Age was the dagger. The earliest types had short, double-edged blades, which were thin and had thick midribs. Their wooden hilts were attached by rivets to the shoulder of the blade. A great number of such daggers is known from early Minoan Crete, where Branigan has estimated that about 80% of metal production on the island went into weapons (Branigan 1999, 88). Although the majority of scholars have interpreted most of those weapons as status symbols, Peatfield (1999) has pointed out that some of the Cretan daggers had actually been damaged, and subsequent changes in their design indicate attempts to make them stronger and more efficient in combat.

As time passed, these daggers became longer and were furnished with even more prominent midribs. It is almost certain that the first Aegean swords evolved directly from these daggers, as is evident by the many similarities in shape and construction features. The earliest swords are long and thin and have rounded shoulders, very short tangs, and prominent midribs. These early swords, known as Type A, have been found in great numbers on both Crete and the mainland. The earliest specimens, dated to ca. 1850–1750 BC, come from Malia and have a length of about 90 cm. Even longer examples are known from the Shaft Graves at Mycenae, which yielded numerous swords of this type, some of which had elaborately decorated hilt attachments and/or blades. This, however, reduced their practical value, as a heavy blow on the edge of the sword could snap the tang or even break the blade itself. The Mycenaeans soon identified this problem and came up with a new type of sword (Type B), which remained in use from ca. 1600 to 1375 BC. This was of medium length, mostly resembling daggers, and was equipped with a longer tang and a slightly wider blade. These modifications increased the weapon's strength and durability.

The next stage in the development of swords was the modification of the hilts and the shoulders of the blade in order to provide protection for the hand. We can identify two main types: Type C was furnished with a pair of horns projecting from the hilt, while Type D had two cruciform projections. Experimental archaeology has shown that these two types were designed for different fighting styles (Molloy 2008; Peatfield 2008, 89–90). The handle of the Type C sword favors a 'saber' grip, which allows for style of fighting that somewhat resembles fencing. In contrast, the handle of the Type D sword favors a 'hammer' grip, which allows more cutting actions. Both types were in use throughout the mainland, Crete, and the islands from ca. 1450 to 1300 BC. The next two types (F and G) were much shorter and more robust, ideal for a range of thrusting and limiting cutting attacks.

The last and probably most important development was the introduction of the so-called Naue II sword (figure 23.1). This type most probably has a Central European origin and appeared in Greece ca. 1230 BC. It has a flanged hilt that is secured with rivets, and the blade has parallel edges for the greater part of its length before tapering to a sharp point. Most of the Naue II swords known are between

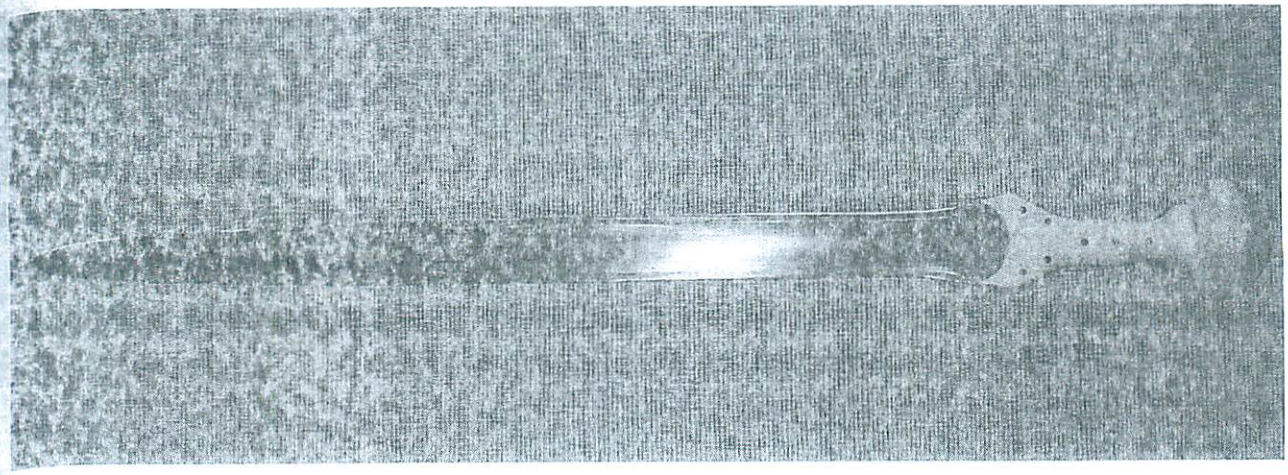

Figure 23.1. Replica of a Naue II sword (photograph by the author).

60 and 80 cm long. This type has been considered as the cut-and-thrust sword par excellence; its design was so effective that the iron version became virtually the only sword used in the Aegean during the subsequent Early Iron Age.

Spears and Javelins

The most common type of spearhead was a narrow, leaf-shaped blade (some of the earlier ones were as much as 50 cm long) with a strongly marked midrib and a socketed base. The spearhead was secured to the shaft by a metal collar at the base of the socket, as well as by pins. Many of such spearheads have been recovered from the Shaft Graves at Mycenae and the 'Warrior Graves' at Knossos. Representational evidence in the form of seals and the 'Lion Hunt' dagger from Shaft Grave IV shows that these large spears were wielded with two hands at shoulder level, although the warriors depicted on the Thera frescoes seem to wield them single-handed. However, as Grguric (2005, 12) points out, the method of holding the spear with both hands, horizontal at shoulder level, is seen only when the shield is placed to the warrior's back. When the spearman is wielding the spear in any other way, his shield is in front of his body. This type of spear would have been used by both infantry (as shown on the Thera frescoes) and by chariot warriors. At the same time, spears were also used for hunting, as the scene from the 'Lion Hunt' dagger indicates.

By 1300 BC, the spear had become a much smaller and lighter weapon, with a length of about 2 m and a blade of 20–30 cm. A wall painting from Pylos, dated to the 13th century BC, shows Mycenaean soldiers fighting barbarians dressed in goat-skins. One of the Mycenaean men carries a spear that he uses underarm, killing his opponent. Moreover, on the one side of the famous 'Warrior Vase' from Mycenae, dated to the 12th century BC, the warriors are portrayed using their small spears overarm, again as thrusting weapons.

Let us now move to the discussion of javelins. Evidence for javelins (or throwing spears) for the earlier periods is meager. There are some examples of small

spearheads, which may have been for such weapons, but we cannot be certain whether they were implements of war or merely hunting equipment (Everson 2004, 31–32). More concrete evidence for their use comes from two frescoes from Knossos. The first, known as the 'Captain of the Blacks' fresco, shows a male figure carrying two light javelins; no other weapons or armor are present. The second, known as the 'Warriors Hurling Javelins' fresco, shows what are probably javelin-armed light infantry, hurling their javelins upward (Grguric 2005, 30).

Bows and Slings

Although no physical remains of bows survive, representational evidence, as well as the large number of arrowheads found all over the Aegean, suggest that the bow was an indispensable part of the Minoan and Mycenaean arsenal. The earliest arrowheads were made of flint and obsidian, while bronze ones started appearing during the 15th century BC. The Shaft Graves yielded several flint and obsidian arrowheads of fine craftsmanship. These could have been used for both hunting and warfare, but as Everson (2004, 32) notes, the barbed heads of some of the arrows clearly suggest warfare, as they inflicted more damage and were difficult to retrieve. On the contrary, in hunting, it was better for arrows to create less damage and be easier to withdraw from the prey.

Under the palaces, the production and distribution of arrowheads clearly became a state affair. At Knossos, 110 bronze specimens were found, while at Pylos some 500 turned up. Moreover, Linear B tablets record large numbers of arrowheads; at Knossos, for instance, a single tablet records 8,640 arrowheads (Snodgrass 1999, 23).

The only depictions of bows used in warfare come from the so-called Siege Rhyton from Shaft Grave IV at Mycenae, which shows three archers in battle in front of the besieged towns walls, and the silver krater, again from Shaft Grave IV, on which archers fight side by side with spearmen (Hiller 1999, 323, pls. LXIX.1b and LXX.9a).

Another missile weapon, the sling, was also in use in Bronze Age warfare. Originally used for hunting, by the 15th century BC the sling had acquired a military role. Sling bullets were initially rounded stones, pebbles, and baked clay pieces, while toward the end of the Mycenaean period lead bullets also appeared. The only representation of slings being used in battle comes from the 'Siege Rhyton' found in Shaft Grave IV, which shows three slingers fighting alongside archers.

Defensive Equipment

Minoan and Mycenaean warriors were provided with an array of defensive equipment such as helmets, body armor, greaves, and shields. Our information about these comes from actual finds, Linear B tablets, and representations on wall paintings, pottery, and jewelry.

Helmets

The most common type of helmet used throughout the Bronze Age Aegean was covered with boar's tusk plates (figure 23.2). So far, more than fifty graves have been found containing plates of boar's tusks that date from ca. 1650 to 1150 BC (Everson 2004, 5). This type of helmet, which is certainly of Aegean origin, was made by a series of small, almost crescent-shaped boar's tusk plates, pierced in the corners with holes and sewn onto a cup-shaped piece of leather or felt in alternating rows. Some of these helmets were furnished with either a plume or a crest or simply terminated in a knob, while most of the latest examples were also equipped with cheek and/or neck guards.

Boar's tusk helmets are frequently depicted on frescoes, seals, and metal vessels. They also appear in ivory inlay work. The Thera frescoes, which date to the 16th century BC, provide one of the earliest depictions, while the wall paintings from the palace of Pylos, which date to the late 13th century BC, provide one of the latest.

Figure 23.2. Boar's tusk helmet from Crete (photograph by the author).

This type of helmet was not the only one used in the Aegean. Metal specimens were also known, as evidence from sites like Knossos indicates. The Knossian example was found in one of the 'Warrior Graves' and is dated to the 15th century BC. It has a conical bowl that terminates in a knob and is furnished with two cheek guards that were sewn onto the bowl.

Around 1200 BC, new types of helmets appear. The warriors on the 'Warrior Vase' are shown wearing horned, black helmets with white dots, which have been interpreted as bronze studs on a leather helmet or an embossed bronze helmet (Everson 2004, 37, with references). Others wear helmets with low 'hedgehog' crests, most probably made of horsehair.

Body Armor

When one thinks of Aegean Bronze Age armors, the first thing that comes to mind is the impressive bronze cuirass found in an early Mycenaean tomb at Dendra in the Argolid. The armor comprises a simple corselet, a breastplate, and a backplate. The neck was covered by a large cylindrical guard, and the shoulders were covered by curved plates. A 'skirt' of six overlapping plates—three at the front and three at the back—hung from the waist, which facilitated movement of the lower body and legs. The plates of the cuirass are about 1 mm thick, and holes with a diameter of 2 mm were punched around the edge for the attachment of a lining. Larger holes about 4 mm in diameter are also present near the edge of all of the plates; these were used to attach the various plates to each other by means of leather straps.

Most scholars have argued that the heavy weight (about 15 kg) and cumbersome appearance of this armor would have made fighting on foot extremely difficult and therefore that it was suitable only for warriors fighting from a chariot. Experimental archaeology, however, has shown that the armor was quite flexible and not especially uncomfortable during hand-to-hand combat (Molloy, personal communication). Peatfield (2008, 93), however, has stressed the fact that "the Dendra armour was not battlefield gear, but rather was designed for dueling." This seems to fit well with the aristocratic nature of the Mycenaean society, where rulers and other members of the elite measured their status and prestige by personal skill at arms.

Another misconception connected with this armor is its supposed uniqueness. Careful examination of finds from Thebes and of representations on pottery has shown that metal armors were quite common in the Bronze Age Aegean. Various metal artifacts found in the 'Arsenal' of the palace at Thebes and dated to ca. 1300 BC have been identified as parts of metal armors. Among them was a pair of shoulder guards, which are smaller than those of the Dendra armor and lack the wide 'wings' that cover the Dendra cuirass at the chest and back (Andrikou 2007, 402). Such differences are clearly due to the development of this type of armor over time, indicating an evolution toward simpler forms that improved the warriors' flexibility (Andrikou 2007, 403).

Metal armors are also mentioned in Linear B tablets from Pylos and Knossos, either in the form of ideograms or with the word *to-ra-ke* (Greek *thorax*). It is worth noting that the ideogram for 'armor' on the Knossos tablets looks astonishingly like the Dendra cuirass.

Later armors seem to be of completely different types. The 'Warrior Vase' from Mycenae shows warriors wearing short, most probably leather, corselets reinforced with metal studs. Scholars have also argued for the use of scale armors, a type typical of the Near East. The evidence for that, however, is extremely scanty as only two scale plates are known from the Aegean—one from Mycenae and another from the site of Kanakia on the island of Salamis.

Greaves

The earliest known greave dates to the 14th century BC and comes from the same grave where the Dendra cuirass was found. It was made from a thin bronze sheet and worn over a legging of linen, leather, or felt. At 32.5 cm long and 8 cm wide, it covered the leg from knee to ankle (Everson 2004, 22). It seems, however, that metal greaves fell out of use, and the majority of warriors wore linen or leather leggings. Frescoes from Mycenae and Pylos show several soldiers wearing white leggings. Their white color most probably denotes the material used (i.e., linen), while three or more bands of red, dark brown, or black under the knees and around the ankles probably designate the leather straps used to hold them in place.

Metal greaves again made their appearance in the late 12th century BC. Two graves in Achaea (Kallithea and Portes-Kephalovryso) and one in Athens yielded a pair each. The Kallithea examples are oval shaped, 25.5 cm long, and 12.6 cm wide. They are embossed with repouseé borders and studs. They are also equipped with lacing wires. For the pair from Kephalovryso we do not have sufficient information, but according to Papadopoulos (1999, 271–72), they are "simpler and undecorated" as compared to the Kallithea ones. The pair from Athens was found in a grave on the slopes of the Acropolis (Everson 2004, 58, figure 23). The greaves are very fragmentary and have no surviving lacing wires. They are oval shaped and are decorated with punch-marked decoration that consists of a border and a central vertical line and six circles on each greave.

Shields

The lack of any physical remains of shields means that our knowledge of their types and function relies almost totally on representations. The several depictions of shields available to us show that during the early phases of the Bronze Age two main types of shield were in use: the 'figure-of-eight' shield and the 'tower' shield. Both types were very large, covering the warrior from neck to toe and were most likely made of several layers of oxhide on a wicker frame, while metal or wooden reinforcements could have also been placed on their faces.

The figure-of-eight shield, as its name suggests, looks like a figure of eight if seen from the front or back, while its profile is highly concave. Slightly smaller is the tower shield, which has straight rims at the sides but an upward curve at the top edge and a slightly concave profile. Both shields were held and maneuvered by means of a leather strap that passed diagonally over the left shoulder. The highly concave profile and the addition of wooden reinforcements on the surface of the figure-of-eight shield would have rendered it especially efficient for breaking into packed formations and also ideal for deflecting missile weapons and blows from swords and spears.

Tower shields went out of use after the early Mycenaean period, unlike the figure-of-eight ones, which seem to have been used until the end of the palatial period, as wall paintings from Knossos, Mycenae, and Tiryns indicate. It was in ca. 1300 BC that smaller shields, either round or with a part cut out from the lower edge, were introduced. The latter are featured on the 'Warrior Vase' from Mycenae.

Chariots

Two-horse war chariots appeared on the Greek mainland during the 16th century BC, as pictorial evidence from Mycenae demonstrates. Their origin must be sought in the Near East, where chariots had been used in battle from as early as the Middle Bronze Age. Although no actual remains have survived, we can get a clear picture of the different Aegean types from numerous depictions on frescos, jewelry, and pottery, as well as mentions in Linear B tablets.

The earliest type, known as the 'box chariot,' was in use between ca. 1550 and 1450 BC. Its name derives from the boxlike shape of the cab, whose sidings rose to thigh or hip height and were covered with some sort of screening material (e.g., leather or basketry) (Crouwel 1981, 59–62). The most common type of chariot, however, was the 'dual chariot,' which was in use between ca. 1450 and 1200 BC. It is so named because its cab was furnished with curved side extensions or 'wings' at the rear. The main sidings and wings were usually covered with oxhide or leather (Crouwel 1981, 63–70). Every type of chariot had two four-spoked wheels and a single pole.

Various theories have been put forward regarding the way these chariots were used in the Aegean. Greenhalgh (1973) has argued that heavily armed spearmen, like the Dendra warrior, charged headlong at each other in mass formation, while Drews (1993) has suggested that chariots were used as archery platforms, much like in Egypt. However, the only Aegean representations of archers operating from chariots concern hunting and not warfare. On the contrary, the majority of scholars believe that chariots were simply used as 'taxis' to take warriors to and from battle. The lack of evidence for protection of the chariots or their horses clearly indicates that chariots "were not designed to appear in the thick of battle, or even to come

within range of enemy missiles" (Crouwel 1981, 145). It is not a coincidence that such a role is echoed in Homer's descriptions in the *Iliad*.

Conclusion

Scholars and students of the Aegean Bronze Age still have to deal with the great misconception that the Minoans were peaceful while the Mycenaean Greeks were warlike. Such notions are too simplified and naïve, and as we have seen, it was on Early Minoan Crete that the first proper weapons appeared. In addition, evidence for conflict *does* exist, as the destruction and abandonment of several Protopalatial sites demonstrate.

It is true, however, that the Mycenaean Greeks took things a step further and invested more in the development of their military infrastructure. The great number and the quality of the weaponry retrieved from the Shaft Graves at Mycenae, as well as the representations of war scenes on the offerings and funerary stelae, clearly illustrate this point.

The early Mycenaeans were efficient warriors who knew and appreciated the skills of both siege warfare and group warfare with units of heavy spearmen, swordsmen, archers, slingers, and chariots. Because all of these soldiers were equipped with the best possible arms of the time, they were eventually enabled to conquer Knossos in ca. 1400 BC and take over the precious maritime trade routes from the Minoans.

During the 13th century BC, however, the Mycenaean military infrastructure underwent a major change both in equipment and tactics. Weapons became smaller and lighter and focused on uniformity and mobility. We are not certain why these changes occurred, but possibly the Mycenaeans had to face new, unknown enemies who fought differently. History has a name for such invaders: the 'Sea People.' Despite all of the changes in equipment and tactics, the Mycenaean civilization collapsed shortly after 1200 BC, and the Aegean sank into a darker age.

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CHAPTER 29

MATERIALS AND INDUSTRIES

DONIERT EVELY

GREECE is adequately endowed with stones (nonprecious), clays, timber, and plant products; metals are somewhat more localized, indeed effectively lacking in Crete (Dickinson 1994, 23–29; Higgins and Higgins 1996; Rackham and Moody 1996). Overseas contacts, thus, were always crucial; 'trade networks' catered to the material needs in the more complex societies and developed periods but arguably existed in less centralized forms long before (Laffineur and Greco 2005). The roots of such procurement and the fundamentals of all crafts utilizing local products reach down into the Neolithic period; the utilization of obsidian is a clear case, but, as is becoming ever more apparent, so is metalworking. The factors behind increased use and acquisition/dissemination of materials, skills, and knowledge have varied; the establishment in EB I/II of settlements with Cycladic links on the north coast of Crete and the east seaboard of the mainland is quite possibly how the early exploitation of copper/bronze and silver/lead was carried forward; the later Minoan 'colonies' on the Asia Minor coastline could have tapped into the resources of the hinterland or existing trade routes—the lack of a translator knowing 'Minoan' is referred to in the tin trade. The same root cause is true for Mycenaean contacts with Italy.

'Tribute scenes' involving Aegean peoples and copies of their textiles, both depicted in New Kingdom Egyptian tombs (Barber 1991, 338–51; Dziobeck 1994; Evely 1999, 137), demonstrate how raw materials and finished goods circulated in more complicated times. Craftsmen, too, may have traveled, as the Minoanizing frescoes at the Hyksos city of Avaris or at Alalakh both arguably reveal (Niemeier and Niemeier 1998). The Uluburun shipwreck (of ca. 1300 BC) illustrates actual transportation of a wide range of exotics and valuables of a decidedly international flavor (Bass 1986, 1991; Pulak 1988); the contemporary Gelidonya wreck carried a less

extensive but still expensive cargo of metals (Bass 1967). Alongside physical items went ideas and words: A Minoan (Keftiu) incantation against sickness is referred to in Egypt (Kyriakidis 2002, 213–16).

Emporia, in the Aegaeum series, has plenty of discussion on matters mercantile, overseas contacts, and the movement of materials (Laffineur and Greco 2005). Localized trading exists in all periods (e.g., in LBA, andesite from Aegina [Runnels and Evely 1992]; lapis lacedaemonius from near Sparta [Warren 1969, 132–33]).

Investigation into the workings of crafts is extensive; far less research is done on the individual tools, assembled toolkits, and their particular usage. Evely has attempted an overview for Minoan Crete (Evely 1993 and 2000); Tournavitou writes on the Mainland (Tournavitou 1988, 1997); and numerous other accounts exist for this or that tool type (note Catling 1964, for Cyprus as a good example). An exception to this empirical approach is made for obsidian and ground stone tools in Carter's work: Based on a thorough study of the data, the deductions are constantly given a social perspective (Carter 1994, 1998, 2004).

Few archaeologists are, or know, skilled craftsmen. Mental efforts and library reading certainly help comprehension, but ultimately ideas need to be tested practically. Experimental archaeology is time consuming and often expensive: Skilled specialists may work with societies outside the Aegean BA time frame. Recent work that applies to Bronze Age Greece includes Minoan potters' wheels and kilns, Mycenaean ceramics, Minoan crucibles, Aegean plaster production and painting, Minoan faience and glasswork, Minoan obsidian blades, and Mycenaean ship construction.

Insofar as one can generalize, recent academic tendencies (e.g., Day and Doonan 2007), while still producing and building on fundamental typologies and categories, are increasingly concerned with the human 'why' rather than the material 'how' or 'what.'

Several crafts made extensive and fundamental use of fire and/or heat in the transformation of their raw materials into finished products: metalworking, pottery making, and the production of faience and glass items.

The working of *metals* is rooted in the later Neolithic into EB I (e.g., Petras, Crete, and Attica [Kakavoianni 2005; Papadatos 2007; Zachos 2007]). Exploitation of these practically useful and socially desirable materials continued most spectacularly where and when the elites could organize matters. Literature detailing the range, typology, and fortunes of object types is extensive (e.g., Branigan 1974; the *Praehistorische Bronzefunde* series); more insights are continually being gained through excavation (e.g., Palaikastro, Crete: Hemingway 1996, 213–52).

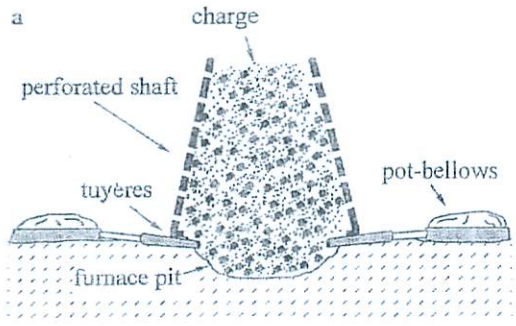
For *metals of utilitarian usage* (copper/bronze), the evolutionary model of their discovery and usage is as follows: native copper/simple ores > arsenical copper > tin bronze, with the superior qualities given by each subsequent alloying process leading to its preferment. This still has some essential truth in it, as copper items that contain arsenic exist before the widespread adoption of tin bronzes. Recent work has suggested that at least some arsenical coppers were produced deliberately (Doonan, Day, and Dimopoulou-Rethemiotaki 2007, 111–13) by adding an arsenic-rich mineral in the smelting process (as opposed to using ores that contained arsenic minerals

naturally) in full cognizance, sooner or later, that a more useful product resulted. The deliberateness of later alloying techniques with tin (and at times lead) is clear. Such 'advances' are not necessarily uniformly adopted everywhere and at the same time: Neopalatial products from Palaikastro (east Crete) have a larger presence of arsenic (perhaps from a greater recycling of earlier metal pieces) than do those at Knossos, where tin was more readily available (Evely and Stos 2004, 269–71). One cannot be sure that practical concerns were always uppermost in determining choices or habits.

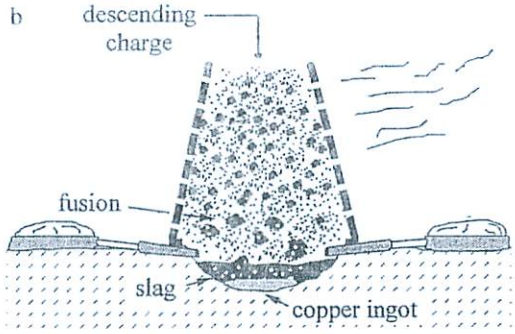
In the EBA (3500–2000 BC), copper and its arsenical version were used mostly for a range of relatively small and simple objects: Some are tools, while others have to do with demonstrations of power and personal appearance (see Evely 2000, 323–97 generally for Crete). The importance of the Cyclades in the spread of these metals and their working has been emerging for a while. In the islands themselves, sites employing varying metal-extracting techniques are known from Kythnos, Syros, and Seriphos among others, and where specific surveys have been carried out (e.g., Kythnos: Bassiakos and Philaniotou 2007), their numbers grow. Along the eastern seaboard of Greece (at Manika and Aghios Kosmas) and the north coast of Crete (Aghia Photia and Chrysokamino to the east; Gournes and Poros from the Herakleion area at the center), sites that look to have deliberate connections with the Cyclades, as early as EB I and II, have been found (Sampson 1988; Mylonas 1959; Davaras and Betancourt 2004; Betancourt 2007; Catapotis and Bassiakos 2007; Galanaki forthcoming; Dimopoulou-Rethemiotaki, Wilson, and Day 2007): metalworking approaches that were part of the cultural assemblage of these newcomers are observable.

Smelting could be undertaken in tapering cylinders of clay, aerated by natural breezes and drafts from bellows (figure 29.1; Bassiakos and Philaniotou 2007, 46; Betancourt 2007, 63; Catapotis and Bassiakos 2007, 76). Fluxes are likely to have been a regular addition to the ore and fuel charge: calc-ferrous at Chrysokamino, Crete. The metals produced sank to the base, where they could have been tapped or allowed to collect in a scoop. Some, trapped as prills in the slags produced, were released by pounding with stone hammers or were even ground out. The subsequent melting and casting processes are better represented: Crucibles are essentially clay bowls on low stems, pierced through to permit a stick, say, to be inserted to aid manipulation (e.g., Betancourt and Muhly 2007); tongs or paired withies as depicted in Egyptian scenes were needed, too. The ceramic technology to make such—and indeed the furnaces, bellow's nozzles, and tuyères—was developed in tandem with the alloying and so on. Here is an early example of one craft's awareness of and indebtedness to another: namely the production of ceramic cooking utensils that also had to withstand thermal shocks.

Casting processes are simple: The existence of an open or single-piece mold of stone or clay is witnessed in the sorts of objects produced, as well as by actual surviving items. The recovery of a two-piece mold of copper in an apparently EM context at Vasiliki suggests that this comprehension may be skewed and oversimplistic (Evely 2000, 358). Such molds, as well as the lost-wax and sand-casting procedures (Fri 2007, 70–72), were made more use of in subsequent phases (MB and LB).



Charging the furnace



The smelting operation in progress

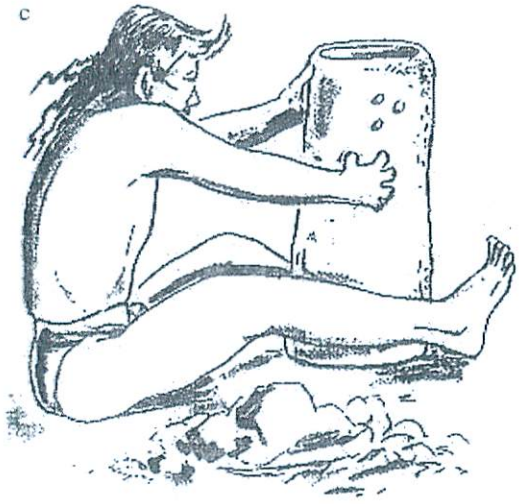


Figure 29.1. Smelting copper at Chrysokamino, Pre-palatial Crete: (a) and (b) the smelt; (c) preparing the furnace (all courtesy of the copyright of Oxbow; Day and Doonan, eds., 2007; [a] and [b] by M. Catapotis, [c] drawing by L. Brock, courtesy of P. Betancourt).

Following the millennium-long development of the EBA, a crucial stage was reached with the rise of the First or Old Palaces on Crete (ca. 2000–1700 BC). This watershed applies to most crafts—on Crete and through it the rest of the Aegean—but can seldom be properly understood. The social changes and stimuli operating seem to have allowed the mastering, within the three centuries involved, of most of the techniques that any craft required; of course, both fashions and the products alter thereafter. The more significant developments were the wider exploitation of metal sources within (e.g., Lavrion) and without (e.g., Cyprus for copper; tin via the Near East) the Balkans and an increased movement of prepared metals as ingots

as opposed to raw ores. Changes in foundry furnishings also occur, if gradually: hemispherical crucibles, at first with a groove on the underside to facilitate handling, improved bellows, tuyères, and so on (Crete: Blitzer 1995, 500–508; Evely forthcoming); a full range of mold types; and the beginning of wider adoption of tin bronze. Now, too, the Minoans first established a network of overseas settlements to secure access to all sorts of materials (Dickinson 1994, 243).

The role of Lead Isotope analysis in establishing the provenance of copper (and silver/lead) has proven vital (Gale and Stos-Gale 2002); chemical analysis of the individual elements within the makeup of an item provides other insights. As with all such scientific advances, initial hopes will always be tempered as the complexities of realities become appreciated (e.g., tin isotopes: Gillis et al. 2003).

As in other crafts, all such fundamental matters become greatly intensified within the time of the so-called Second or New Palaces on Crete (1700–1425 BC). Increasingly, the mainland sphere (the Peloponnese and central Greece at least) borrows the trappings of Minoan finery and knowhow, either directly or through the Cyclades. Around 1450 BC the mainlanders emerge as the dominant force within the Aegean: Crete remains an integral part of this until the loss of the final palaces there by 1300 BC, after which the island's role declines. Now and in the ultimate Postpalatial phase (down to 1050 BC), a still wider search for metal sources deserves attention: Copper from Sardinia is part of the new Mycenaean interest in the West, while Cypriot mines are tapped more than ever before (Gale and Stos-Gale 2002). Aegean groups begin to settle and roam the east Mediterranean, some in the guise of the Sea Peoples.

The replacement of copper and bronze by *iron* is a complex issue and still not well understood. Present thinking can be summarized thus: The standard model (Snodgrass 1980) sees 12th-century BC shortages of tin leading to a growing appreciation of iron, whose ores were in any event more widely available. This postulated lack of bronze is questioned. Sherratt (1994) argues that Cypriot entrepreneurs began to market iron, which can be regularly produced in small quantities as a byproduct in copper smelting. Haarer (2001) sees a deliberate development from a still broader, Near Eastern use of iron in the Bronze Age.

For *precious metals* (gold and silver), the cupellation of silver and lead late in the Neolithic and the start of the EB (see earlier) marks a significant discovery beyond what scholarship had earlier deemed likely. Lead Isotope work has assisted with the provenancing of silver, but little yet can be done with gold—and may never be possible, given its ready reuse and mixing. Otherwise, advances are mostly in the realm of technical appreciation, for instance, the manufacture and use of granulation (Politis 2001).

The increasing sophistication and levels of skills within the EBA have long been appreciated (e.g., an early reliance on inserting, folding, and twisting as the means of assemblage starts to give way by EB III to fusing and soldering inasmuch as the development of colloid hard solder allows great subtlety of handling). By MB in Crete, all of the required processes were in place; thereafter, advances were again more in the nature of design and complexity in assembling component parts. The creation of the gold bezel rings (requiring both three-piece and lost-wax molds;

chasing and engraving; at times inlaying) demonstrates the mastery attained. Comprehension of their manufacture has been aided by the recent use of X-ray photographic techniques and ultrasound (Müller 2003a, 147–50; 2003b, 475–81). In contrast, the gold foil beads of the LB are made in molds in numbers that speak almost of mass production (Boulotis 2000). The exploitation of niello (Boss and Laffineur 1997) recalls the interest in developing manufactured compounds, elsewhere most readily seen in faience/Egyptian blue.

The handling of fine sheet, foils, granules, and wires was developed particularly by this side of metalworking (Evely 2000, 401–44 generally for Crete), but developments ran broadly in parallel with the utilitarian, which is not surprising as the skills of each are frequently found combined on the one object (swords in particular).

In *ceramics*, interest has focused mostly upon provenance/trade and the technology of manufacture (Evely 2000, 259–322); deductions made from these have permitted speculation on social dimensions. Crucial to all has been the expansion of fabric analyses, departing somewhat from the strictly chemical-based approaches in favor of categorizing the physical makeup and components of the paste (see much of the work by Day, e.g., Wilson and Day 2000). Typical conclusions so reached have indicated Early Neolithic sites outside Knossos in the Mirabello area (Tomkins and Day 2001) and allowed the appreciation of the extensive degree of local production in EM Crete and accompanying movement of vessels within the island (Whitelaw et al. 1997). Quite subtle conclusions are possible now as the reference collections expand.

Information is also obtainable on and through manufacturing techniques. The recognition of an unusual combination of different clays for different parts of the body in some Mesara EM wares not only demonstrates the existence of a local tradition well removed from, say, that of contemporary Knossos but also shows the strength or conservatism that may operate regionally (Todaro, pers. comm.). In turn, the identification of such regional patterns (a combination of clay, manufacture, shapes, and decorative finishing) has been offered as a potential indicator of the growth of social identities, groupings, and even 'states' (Cadogan 1994; Knappett 1997). Xeroradiography and kindred techniques help reveal how a vase was formed (Müller 2003a, 150–51; the research project of Berg at Manchester University): The focus here is often on questions of hand- versus wheel-made pieces. As well as illuminating local traditions again, potential insights are offered into matters such as the adoption of the wheel. Were such, for example, taken up first and most fully under the stimulus of elite groups? Experiments assist greatly: The physical form and capabilities of the Minoan wheel are now better appreciated (figure 29.2; Evely et al. 2008), and kiln firings, too, help comprehension of the controlling of temperature and atmosphere critical to such as the mottled Vasiliki and Urfinis wares of the EB and the Kamares pottery of MM times (unpublished experiments by both Moody and Politis on Crete).

In the EB period, pots were handmade: Leaves, basketry mats, and clay discs provided the moveable bases for the smaller and medium vessels, as imprints on their bases show. Coil production is the approach most commonly recognized, though slab and paddle-and-anvil techniques sometimes occur. An interest in

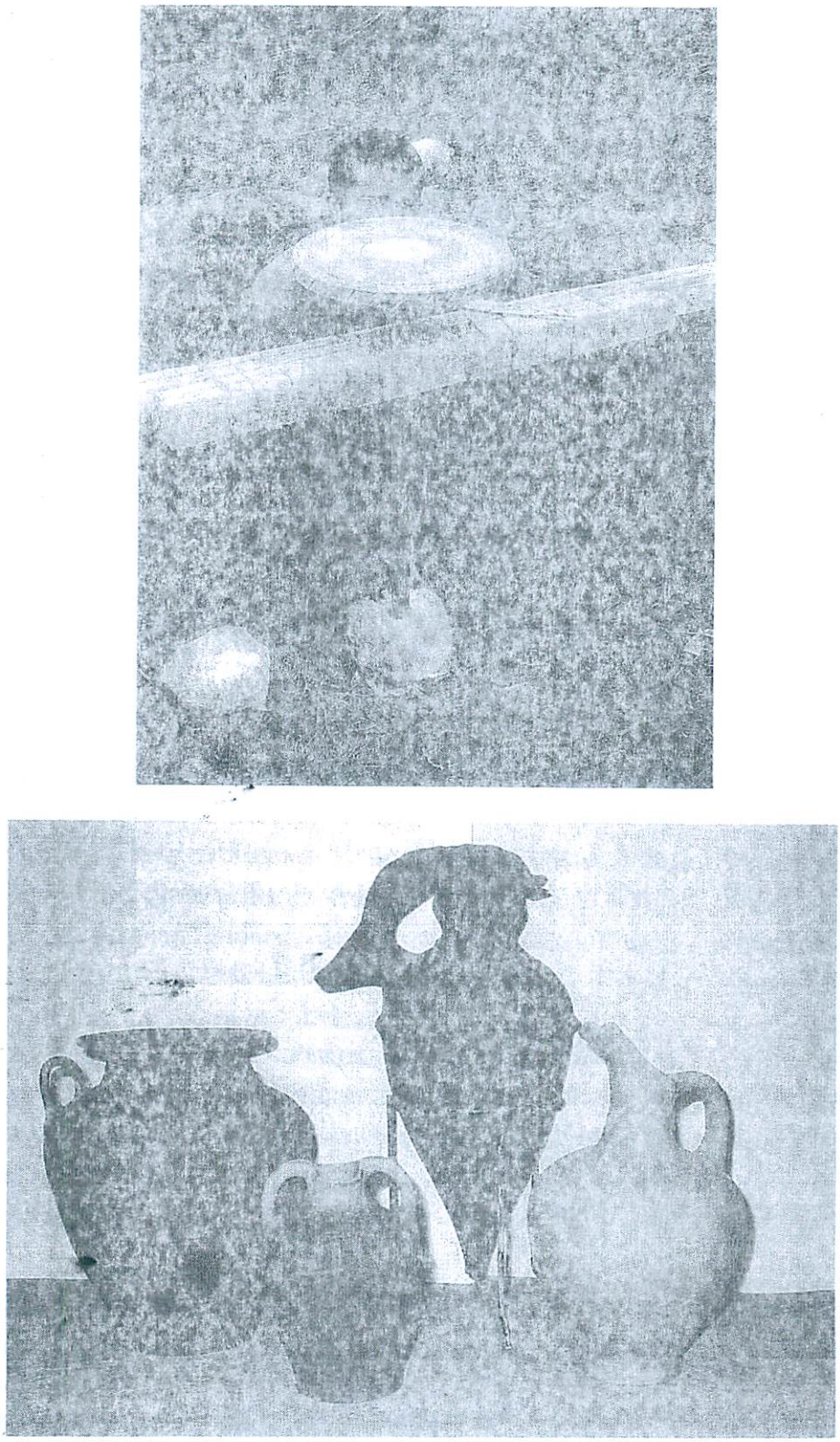


Figure 29.2. Experiments with a Minoan potter's wheel (courtesy of the author).

decoration—in paint (contrasting with the fabric's color) and burnishing—is manifest from the start; in this both regionalism and an overarching awareness on a broader scale are noted (Betancourt 1985; Wilson and Day 1994; Momigliano 2007). Firing techniques were controlled and sophisticated enough to produce the Vasiliki and Urfinis wares, as were others when a reducing atmosphere and

gray finish were desired. These achievements all argue for the existence of kilns proper, which is no surprise, given what metallurgists did regularly in smelting furnaces. In early MM times this promising start was taken further on Crete, where the best of the Kamares wares combine exquisite control of the fabric to produce eggshell thin wares, of a wide range of pigments and their application in complex patterns, and of the controlled kiln firing, which produced the semiglaze effects in the black iron-rich background coloration (Evely 2000, 291; Faber et al. 2002). The wheel, too, now gains ground, but coils were now and later always used for larger vessels. The LB period sees the decorative aspect reach its zenith first on Crete and then in the hands of the mainland Greeks, whose technical skills produced harder-fired fabrics. The kiln types evolve: The short-lived, channeled kiln of Neopalatial Crete is replaced by the updraft version of probable mainland development (Evely 2000, 300–11). Unlike many crafts, ceramics was not especially depressed by the demise of the palace-centered lifestyles at the end of the BA (less time was spent in decoration), a fact that demonstrates both its central role and widely dispersed distribution.

For the last of this pyrotechnical trio, namely *faience* and *glassmaking,* research has built on the like of Foster's account (1979), largely of late concentrating on faience. As well as seeking to analyze and define more accurately the composition of cores (and thus distinguish between different approaches and times), effort has gone into elucidating possible manufacturing techniques by using analytical and macroscopic avenues (Panagiotaki 2005). Insights so obtained have guided choices of raw materials and preparation procedures in experimental work (Sklavenitis 2007).

A 'high-tech' pair of crafts (Evely 2000, 445–69), that of faience, was introduced first into the Aegean from the Near East in the EBA: only small pieces, often simple jewelry, were first manufactured. The Minoans made the most of this in the MM and early LM periods by extending the polychrome potentials. Blue frit (Egyptian blue), a material intermediate between faience and glass, is an example of a purely synthetic substance. (The short-lived trial in EM Crete with the 'white pieces' appears to be a comparable venture into synthetic substances: Krzyszkowska 2005, 72–74.) Glasses (and related enamels) were more to mainland tastes and a later development. At present it is not clear whether glass was itself manufactured in the Aegean as opposed to being imported in ingot form for remelting.

Both substances rely first on a proportional preparation of the ingredients, frequently on molding techniques and then the application of heat. The items produced in faience in MB and LB times were often still small in size but intended for inlay on a grand scale (e.g., the Town Mosaic of Knossos); such may closely recall the products of ivory/bone working. Larger composite pieces in the round, such as the Snake Goddesses from Knossos, can also share features of concept and preparation with that same craft. The mold-made glass beads of the LBA are the equivalent of the gold-foil ones mentioned earlier: every bit as much production on the grand scale. Whether glass vessels were made in the Aegean is uncertain.

As a postscript come *plasters* and *frescoes.* The role of fires and furnaces is here limited to the initial production of the raw material, which when slaked makes the

basic plaster. Earlier art-historical approaches always considered the workings of the societies depicted in them, but they have now been linked to scientific analyses of the pigments and the actual makeup of the plaster (Cameron 1975; Evely 1999, 2000; Morgan 2005; Brysbaert 2009). The recovery of Minoan-style/executed frescoes in the Near East and Egypt have opened up the possibilities of traveling/loaned craftsmen, a phenomenon that certainly occurred in the Near East (Bloedow 1997; Niemeier and Niemeier 1998, 2000; Boulotis 2000).

Plasters (of mud) were well exploited in the Neolithic period, and this basic use was never lost in the Aegean. Within the EBA, the earliest lime plaster is adulterated with clays and coarser aggregates; decoration is simple in range and manner. The next step is associated with the palatial structures on Crete; gradually improving in the lime percentage, by the Neopalatial era, plaster regularly attains at least a 90% level in lime (Brysbaert 2004; Jones 2005). Similar plasters may be used from floor to ceiling (with especially durable admixtures containing small pebbles developed for floors): All may be painted, and some can incorporate low relief work. Methods of application (pegs, trowels, floats, and burnishing tools) and of the layout of the decorative techniques (strings, rulers, sketches in ink or with a point) are often detectable (Evely 2000, 471–84).

At its zenith between 1700–1500 BC, fresco painting was undertaken all over the Aegean and attained exquisite levels within the elite buildings. Akrotiri, on Thera, is proving the best source for understanding all aspects of this craft, as well as being a constant source of visual pleasure (Morgan 1988; Sherratt 2000). Though the 'buon fresco' technique is well attested from the malleable state of the plaster, 'secco fresco' was also likely known; indeed, the two can be found on the same wall. The pigments were prepared from naturally occurring soils (many involving iron compounds), with blues alone being a synthetic compound; mixing gave a wide range of hues. The overall effects are to encompass the viewer in a total visual effect; stories are being referred to (social events; scenes set in the natural world)—it is never just wallpaper. With the loss of such patronage, matters reverted fairly swiftly to fundamental and practical standards of lime and mud plasters.

Working in stone followed two main and distinct paths. The first, not discussed here, is concerned with architecture and engineering, some of which works were on a monumental scale—tombs, fortifications, and aspects of land reclamation and water control (Knauss 2005; Palyvou 2005). Occasional pieces of associated ornament are also on the large size. Otherwise, the two main focuses are smaller items: stone vases and again seal stones and jewelry elements. In both cases, scholarship has concentrated mostly on questions of technology and categorization, though work by Bevan and Krzyszkowska introduces the social, too (2007 and 2005, respectively).

Stone vases have a link to the Neolithic past (Devetzi 2005). The traditions of the EBA emerged most strongly on both the Cyclades and Crete, with an initial emphasis on a relatively small size. On Crete, the toolkit first included chisels, blades, saws, hammers, and abrasives, and only later did drilling become a standard and important practice (Evely 1993, 172–94 generally). Once conversant, the Minoans produced works of a startling quality and in quantity; making use of imported

materials alongside native ones, they practiced their craft at many sites, combining appreciations of form, color, and patterning every bit as complex as those seen in ceramics (Warren 1969). The relief vases contain valuable renditions of events of daily and ritual nature/occurrence (Warren 1969, 174–81). With the emergence of the mainlanders in the LBA, this craft largely went into recession. Vases continued to be made—some indeed elegant and ornate (Sakellarakis 1976). However, the range of products collapsed; softer stones were again employed for a while. This pattern indisputably reveals how much an 'elite' craft this had become and in this case especially connected with Minoan Crete.

Seal stones are valuable evidence today for understanding spheres such as administration and economy, whose role in the past was more personal but also connected with status. Neolithic stamps (pintaderas) belong to the peripheries of the Aegean and do not obviously connect with what arises in the EBA. At that time the mainland and Crete pursue different trajectories, but both produce complex pieces of aesthetic merit (Krzyszkowska 2005). Cretan evidence is far fuller and seems to cover a wider range of materials. Common to both are soft stones (wood, too, may be assumed); the mainland has clay in addition, while Crete utilizes bone, hippo ivory, and the 'white pieces' (see earlier). Knives, burins, and handheld drills are the basic toolkit (Evely 1993, 146–71 generally). By MM II, hard semiprecious stones are worked alongside the softer; new tools (bow-driven drills and cutting wheels; emery abrasives) were the secret of these often bravura treatments in miniature. Numerous styles are recognized, and attempts to divide the corpus up, à la Beazley, abound (e.g., Boardman 1970; Yule 1980; Betts 1981; Younger 1983). The mainland adopted all of this early in the LBA, though eschewing the softer stones at first. After LB IIIA, a shift occurs in both regions, perhaps again indicating the prime position of Crete in this craft. New Cretan production is limited, while the mainland adopts softer materials to satisfy its still considerable need for seals. The eventual demise of the palaces left only older pieces in circulation, sometimes for centuries.

Ivory/bone and *shell* working is a long-lived craft whose Neolithic antecedents are largely domestic in nature but also involved the decorative (figurines). Monographs by Poursat, Sakellarakis, and Krzyszkowska cover many aspects of BA typology, manufacture, and development, both utilitarian and ornamental (1977, 1979, 1990, respectively). Experiments on the toolkit have been made by Evely (1992, 1993). Since ivory was always imported, it serves as another indicator of trade and contacts. The craft as a whole acts as a mirror for comparable work in wood and has ties, too, with stone working on a smaller scale.

In addition, EBA production involves small-size pieces. The Cyclades continued in particular to exploit a source of Spondylus shell; the Minoans worked in all classes (note that of the ivories, only hippo is known at first: Krzyszkowska 1988) and produced mainly seals outside the domestic range of items (Evely 1993, 219–56; 2005). As metal tools became more common, the potential for small-scale inlay, as well as pieces in the round (figurines), was advanced in MM Crete (local preferences/availabilities are evident: Malia makes more use of shell than Knossos). Saws, chisels, blades, drills, and abrasives have all left their traces. With the Neopalatial era

and the regular availability of the larger elephant ivory tusks, the quantity and physical size both increased. The Minoan composite figurines are justly praiseworthy: The Palaikastro 'kouros,' with its combination of hippo ivory with serpentine, rock crystal, gold, a blue pigment, and probably wood, is a prime example (MacGillivray, Driessen, and Sackett 2005). Indeed, this admixture with other substances (faience, silver, and other stones and pigments are also represented) is a hallmark of the craft now. A craftsman's house at Knossos yields a rounded picture of the production sequences (Evely 1992).

The mainlanders continue much of this in the LB (e.g., Tournavitou 1995, 123–206); figurines drop from the repertoire, but other items were developed (e.g., mirror handles). Inlaid furniture is a favorite. Their aesthetic style alters (as is evident in pottery and frescoes, too), with a stiffer, more grandiose, and even overly ornate feel prevailing. Certain materials and object types of local origin circulate in the Aegean now—often utilitarian in character: The possible spatula made of red-deer antler can be placed alongside the tripod mortars of volcanic stone and the clay 'spool.'

The remaining crafts can be categorized as perishables. Inevitably, only rather indirect lines of inquiry now exist. For *woodworking*, any evidence of major concerns such as shipbuilding will come only from shipwrecks (Uluburun, for example), though the recent discovery of shipsheds in Herakleion may add ancillary details. Here, too, experimental work is adding a further dimension (Kamarinou and Baika 2005). Though the Linear B tablets record wide and subtle appreciation of different timbers and their uses, only Thera regularly provides examples (in negative, by means of plaster casts) of actual furniture (beds, stools, and such: Speciale 2000; Polychronakou-Sgouritsa 2001). Work on a smaller scale can be more directly surmised from such as ivory inlay work; the toolkit is well represented with some impressive pieces in recovered bronze, such as the two-man saws (Evely 2000, 528–37).

Perfumes are served slightly better. A considerable body of receptacles for burning aromatics, of largely later MBA and LBA date, has been collected (Georgiou 1980). Two other avenues exist; the first concerns references in Linear B tablets from Crete and the mainland (Knossos and Pylos), which detail aspects of land usage and the harvest size expected, and also lists of ingredients that could be so utilized (Enegren 2000, 33–34; Shelmerdine 1985). The second approach is through analytical archaeology (organic residue, still a much-debated process): From the cemetery of LM Armenoi, traces of an oil allegedly derived from iris was recovered from fireboxes, themselves decorated with iris flowers (Tzedakis and Martlew 1999).

Finally come *textiles*. Well enough served as this topic is, if indirectly, by the evidence of frescoes, by innumerable loomweights of clay, and occasionally by other weaving apparatus (also by experimental work: Andersson and Nosch 2003), yet nothing much else remains (Evely 2000, 485–510; Tzachili 2005). Rather it is the unraveling of the tablets' cryptic listings by Linear B specialists that represents a triumph, thereby revealing the organization of the breeding of sheep, the collection of their wool, and its subsequent transformation at the hands of labor forces and specialists, usually supported on rations (Killen 1964). The evidence is most extensive for the period of mainland control at Knossos (1425–1350 BC): The social

aspects of the labor force, the systems of exploitation, and the degree of control exerted by the elite are remarkably apparent.

As has been touched upon throughout, the drawing out of social insights has been a major concern of recent research. The evidence presented by Linear B assists greatly in this endeavor (*Documents in Mycenaean Greek*, new edition forthcoming); it encompasses, most obviously, simple names of craftsmen (e.g., kowirowoko: seal engravers; kuwanowokoi: glassworkers), products (erepatejo: of ivory; eteja: a type of oil; topeza: a table), and the system that ran it all (tarasija: the standard work cycle). The teasing out from the tablets of such sets of information as the textile production at Knossos or the bronze working and perfume making at Pylos represent major achievements (also Shelmerdine 1987). Outside this window of literacy, the view of necessity remains stubbornly obscured. The degree to which one now ventures into the realms of supposition, analogy, and metaphor to seek explanations will depend on the individual scholar's proclivities and character.

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CHAPTER 34

ERUPTION OF THERA/ SANTORINI

STURT W. MANNING

ALTHOUGH human lives, and history, are full of specific and key moments, finding these in a useful form in the archaeological record is a rare occurrence; too often one is faced with a challenging palimpsest. But one especially dramatic type of archaeological moment, or short-lived horizon, occurs when a large volcanic eruption devastates a region. A world is, tragically, captured (entombed, frozen) forever at a specific time—in toto. The most famous example is the eruption of Vesuvius in AD 79. Although this catastrophe extinguished and entombed Pompeii and Herculaneum, it has provided archaeology with an unparalleled set of evidence (e.g., Berry 2007). The prehistoric 'Pompeii' of the Aegean world is the horizon of time sealed by the great eruption of the Thera/Santorini volcano in the Aegean in the mid-second millennium BC (Friedrich 2000). This eruption entombed a thriving city with international links (referred to as Akrotiri, from the name of the nearby modern village) and other settlements on Thera, and, through the spread of a tephra blanket (airfall volcanic ash/debris), laid down a clear marker horizon across much of the southern and eastern Aegean, western Anatolia, and some of the East Mediterranean (which can be traced by modern scientific means, e.g., Bichler et al. 2003).

The prehistoric archaeology buried by the volcano on Thera was recognized in the late 19th century AD (Tzachili 2005), but modern excavations started under Spyridon Marinatos only in 1967 (Marinatos 1968–1976); work has continued from 1974 to the present under the direction of Christos Doumas (e.g., 1983, chapter 56 this volume). The extraordinary and unique finds at Akrotiri—a large town of buildings preserved to several stories (and with earlier remains underneath), millions of artifacts, and, most famously, room after room of astonishing wall paintings—make the site—and the eruption that both destroyed and created it (for the modern

world)—pivotal and compellingly central to Aegean and wider East Mediterranean prehistory (Palyvou 2005; Sherratt 2000; Manning 1999; Forsyth 1997; Doumas 1983, 1991, 1992; Doumas, Marthari, and Televantou 2000; Hardy et al. 1990). The volcanic eruption itself was an epoch-scale event—one of the larger volcanic eruptions of the last several thousand years (with recent work making it only larger: Sigurdsson et al. 2006)—and it had a substantial, shorter-term impact on the region beyond Santorini, ranging from direct airfall tephra damage in the southeast Aegean, associated seismic and especially tsunami impacts, to (debated) effects on the environment and even the climate over the subsequent months to years (Bruins et al. 2008; Frisia et al. 2008, 26; Bottema and Sarpaki 2003; Eastwood et al. 2002; McCoy and Heiken 2000; Manning and Sewell 2002; cf. Pyle 1997). Marinatos (1939) famously suggested that the eruption might even have caused the destruction of Minoan Crete (also Page 1970). Although this simple hypothesis has been negated by the findings of excavation and other research since the late 1960s (e.g., Renfrew 1979; Doumas 1990; Hardy and Renfrew 1990; Soles, Taylor, and Vitaliano 1995), which demonstrate that the eruption occurred late in the Late Minoan IA ceramic period, whereas the destructions of the Cretan palaces and so on are some time subsequent (late in the following Late Minoan IB ceramic period), some scholars nonetheless continue to see the volcanic eruption as a pivotal event that caused the downturn (or beginning of the end) of Minoan civilization (Driessen and Macdonald 1997).

When did this important eruption occur?

This seemingly innocent question has been the source of a major controversy in Aegean prehistory for a generation (e.g., Michael 1976; Warren 1984; Betancourt 1987; Manning 1988, 1999, 2007; Hardy and Renfrew 1990; Bietak 2003a; Wiener 2006, 2007). Let us begin with what is agreed and then move on to what is debated and why.

Relative Date

The placement of the eruption in the archaeological sequence of the southern Aegean is now more or less universally agreed: toward the end of the Late Minoan (LM) IA period in terms of the Cretan sequence (this is based both on comparison of the Minoan ceramics buried by the eruption at Akrotiri with Crete and on the presence of direct airfall Minoan eruption products in late LM IA strata/contexts on Crete). A final posteruption stage of LM IA may have followed, but a mature/late LM IA date is clear. In terms of the mainland sequence, the eruption is very late in Late Helladic (LH) I or perhaps even LH I/IIA border or into the very start of LH IIA (one vase in particular from preeruption Akrotiri looks LH IIA in style) (Warren 2007; Hardy and Renfrew 1990; Manning 1999, 12–19). This relative archaeological placement can be extended outside the Aegean through linkages between the Aegean worlds and those in the East Mediterranean especially. In particular, a direct

linkage between preeruption Thera and Cyprus likely exists with apparent imports/exports in both directions, tying Late Cypriot IA to Late Minoan IA (Cadogan 1990, 95; Vermeule and Wolsky 1990, 382 and note 76, 394; Merrillees 2001).

So when did the eruption and late LM IA occur?

Absolute Date

The Problem

The traditional approach to absolute dating in Aegean prehistory has been to find exports to or imports from the approximately historically dated world of Egypt and then best estimating the Aegean ceramic periods around these. For periods during which there were clear and plentiful contacts, this procedure works well. Examples are the linkages of the main Old Palace (Kamares) phase (Middle Minoan II) on Crete with Middle Kingdom Egypt (and so the 19th–18th centuries BC) or the (very specific) correspondence between the LH IIIA2 period and the short-lived Egypt capital of Tell el-Amarna under Amenhotep IV (Akhenaten) in the mid-14th century BC. No one contests these dating 'pegs,' which have long been clear (e.g., Cadogan 1978), and recent science dating, where available, finds compatible outcomes.

However, there is no good evidence from Egypt for the date of the LM IA period. A couple of LM I (B or maybe A) or contemporary LH items and then a few agreed mature/late LM IB objects are found in Egypt in contexts of the earlier 18th Dynasty (with the LM I characterizing the earliest but least well known horizon from Ahmose to Thutmose II, ca.1540–1482 BC and the transition from the late LM IB material to Mycenaean vessels occurring during the reign of Thutmose III, ca.1479–1425 BC, with an example of LH IIB—largely contemporary with LM II on Crete—found also in a 'typical tomb group datable to the reign of Thutmose III' [Aston 2003, 140–45; see also Warren and Hankey 1989, 138–46; Egyptian dates taken from Kitchen 1996; Hornung Kraut, and Washburton 2006]). All of this, however, merely sets a point before which *(terminus ante quem)* for the LM IA period. Depending on variables such as whether these vessels were interred immediately or later after use, some to most of the LM IB period lies before the time they arrived in Egypt. If the LM IB period is considered short—as it was thought to be until recently—this could suggest that late LM IA was perhaps in the later 16th century BC (an end-date of 1500 BC was the initial 'round number' approximation, e.g., Warren 1984; more recently, dates a couple or a few decades earlier have been entertained: e.g., Warren and Hankey 1989, esp. 215; Warren 2006, 2007; Wiener 2006). If the LM IB period is long—as now is seemingly clear from both the archaeological and the science-dating evidence from Crete (Betancourt 1998, 293; Rutter n.d.; Manning

2009)—then this same evidence could indicate that late LM IA was somewhere in the later 17th century BC down to around 1600 BC (or roughly a century earlier).

The 'Short chronology' was the interpretation of the mid-second millennium BC Aegean that became conventional or orthodox in scholarship through the AD 1980s (see, for example, the chronology of Warren and Hankey 1989, 169). However, subsequent archaeological work (see especially Rutter n.d.), as well as reconsideration of how to interpret the archaeological linkages between the Aegean and Egypt (Kemp and Merrillees 1980; Betancourt 1987; Manning 1988, 1999, 2007), and especially the application of science-dating techniques (in particular, radiocarbon dating: discussed later) have raised major questions about this dating in recent decades. This evidence suggests a long LM IB period (early/earlier 16th century to the first half of the 15th century BC) and a date for the eruption of Thera in the late 17th century BC. Dates for the eruption from environmental records (especially ice cores and tree rings) have also been suggested as relevant (see later). Some are possible (although some have been strongly criticized), but as of now (AD 2009), none are clear or established (and generally what seemed more plausible in the late AD 1980s–1990s has became less evident or more complicated as a result of more critical examination and further work).

A clash of scholarly cultures has developed. Some archaeologists simply state that the conventional interpretation of the archaeological evidence is secure and superior and that any suggestion to the contrary by science dating simply means something is wrong with the science dating or its analysis (Bietak 2003a; Wiener 2003, 2007). A variety of supposed or claimed possible problems with radiocarbon dating are listed—but never demonstrated as relevant—to justify ignoring this evidence. Meanwhile, others have accepted the worth of the case built from a large number of radiocarbon determinations and have concluded that the archaeological evidence can be reinterpreted in a consonant fashion. Warbuton (2009, 139–144) goes even further: critically questioning the supposed stratigraphic sequence at the key site of Tell el-Dab^{c}a in the Nile Delta (noting the conspicuous lack of suitable published evidence to support the many specific stratigraphic and assemblage claims made), and suggests that it is perhaps the claimed interpretation of this site, and not radiocarbon, that is the main problem. There has been little common ground.

Archaeology

No fundamentally key archaeological evidence for this problem has helpfully turned up in the last generation to resolve or advance matters. The situation remains where there is a conventional interpretation or viewpoint (Short or Low chronology), but it abides now simultaneously or in parallel with an alternative analysis (High or Long chronology) or at least a clear ambiguity that allows plural interpretations, as argued by Betancourt (1987, 1990; see also Kemp and Merrillees 1980; Manning 1988, 1999, 2007; and see generally conference volumes such as Hardy and Renfrew 1990; Balmuth and Tykot 1998; Bietak 2003b; Bietak and Czerny 2007).

This lack of progress has not been for want of effort. Some spectacular wall painting fragments of a Minoan-like type have been found at a major site (Tell el-Dabʿa) in the Nile delta (Bietak, Marinatos, and Palyvou 2007). After first being dated to the Hyksos period, they are now assigned to the Thutmosid period, likely the reign of Thutmose III (see Bietak, Marinatos, and Palyvou 2007, 39–40, with key stratigraphic support summarized on pages 21, 27). A secure linkage to Thutmose III awaits publication of the full ceramic evidence. The limits seem to be as follows: First, from his ceramic seriation, Aston (2003, 143) says the relevant upper stratum 'cannot really be any earlier than the reign of Thutmose III,' and the lower limit seems to be Amenhotep II (see Bietak, Marinatos, and Palyvou 2007, 21, 27, and the description of the phase C/2 = stratum c magazines that cut into deposits with painting fragments on p. 21). The paintings are in the earlier part of this range and are therefore likely Thutmose III in date.

These paintings have been much discussed. The excavator, Manfred Bietak, trenchantly argues that they are very similar to the Akrotiri wall paintings from Thera and thus that they are of earlier LM I date. He sees a very short/low chronology, with this context of the early to mid-15th century BC only some decades at most after the Thera eruption (which he would date ca. 1500 BC *or later*). Nonetheless, the paintings are simply not LM IA in style. At the earliest they are late LM I (i.e., late LM IB) and, in all sense and likelihood, are in fact LM II-IIIA in style and date (Shaw 2009 and Younger 2009), linking especially to a group of LM II wall paintings known from Knossos, which was the new, single-palace supersite of Crete and the southern Aegean at this time and with good evidence for high-level contacts with Egypt, including, from its port area at Katsamba, Thutmose III (Manning 2009 and references). Thus, one could merely state that these paintings offer ambiguous evidence; alternatively, they may well support a rethinking of the Short chronology. However, they do not offer a clear resolution that everyone will accept.

Finds of pumice in the East Mediterranean from the Minoan eruption have been noted, and their presence especially in Tuthmosid contexts in Egypt has been held by some to suggest that the eruption occurred around this time (e.g., Bietak and Höflmayer 2007, 17 and references; Bietak 2003a, 28). However, this argument has failed to gain traction. The pumice was used in craft workshops and was collected (and maybe even traded), and we have no idea how long it had been lying around before use (just as it has been regularly used in many other, later prehistoric contexts down through the Classical period and beyond). We also lack many contexts for the 16th century BC from which to see whether they, too, have Minoan pumice—thus, the presence/absence case is weak.

Other recent attempts to claim that a category of artifact type does or does not resolve the short/long debate have failed to convince those already not committed to one side or the other. Either the evidence is not of sufficient resolution or clarity to preclude one side or the other, or it can reasonably be reinterpreted (or less determinedly interpreted in one way). For example, it is argued that a couple of stone vases (one from Shaft Grave IV at Mycenae, one from Akrotiri) are Egyptian and specifically of 18th-Dynasty date (with linkages especially drawn from the reign

of Thutmose III) (Warren 2006). Therefore, the implication is that the LH I/LM IA periods must overlap into the 18th Dynasty (and hence continue after ca. 1540 BC) and, given the specified Thutmose III parallel, perhaps last even into the 15th century BC. As stated, this seems key evidence, but it is not in fact certain that the vessels are Egyptian (there has been debate over several other claimed Egyptian stone vessels: Lilyquist 1996, 1997), and, more critically, the stylistic dating, which places them exclusively in the 18th Dynasty, is not demonstrated. Although there are undoubtedly good 18th-Dynasty parallels from the several known 18th-Dynasty assemblages, the types could also date earlier (a notable feature of earlier 18th-Dynasty material is that much of it is a last stage of development of Second Intermediate Period types, as is also the clear case for the ceramics; see, e.g., Aston 2003, 142). Here we have less convenient assemblages for comparison also, which makes it especially hard either to prove or to rule out a pre-18th-Dynasty (Second Intermediate Period) dating. Thus, the case is neither clear nor resolved.

There are several other examples of a similarly ambiguous or nondecisive nature (unless a particular interpretative slant is applied). For example, Koehl (2000) has suggested that rhyta made in Egypt in the earlier to mid-18th Dynasty are more like LM IA types (and so some see this as evidence that LM IA was contemporary: e.g., Bietak 2003a, 29), but the situation is not so simple. The mechanism, directness, and specificity of the link between the Aegean form and those in Egypt is unclear (which have non-Aegean decorations—the supposed link is just the shape/form); moreover, LM IA–style rhyta continue into LM IB (as Koehl 2000, 95, notes), even if a direct influence is sought (and, of course, they appear, even if modified, also in the later years of Thutmose III, held by figures dressed in kilts of LM II–IIIA style: Koehl 2000, 97–99; for the kilts see Rehak 1996, 36–37; Betancourt 1998, 293; Barber 1991, 348; 1993). Furthermore, other LM IB, LH IIA, and even LM II objects occur in earlier to mid-18th-Dynasty contexts (Kemp and Merrillees 1980; Warren and Hankey 1989; Warren 2006). Moreover, during the reign of Thutmose III there is good evidence for a linkage to LM II (Manning 2009); hence, these rhyta may not offer a suitably sensitive comparison. Similarly, analysis of the metal vessels depicted with the Keftiu (= Cretans, it is assumed) in paintings in some Egyptian tombs (Mätthaus 1995) is capable of being consistent with either the short or the long Aegean chronology.

The net result is something of a stalemate from the point of view of archaeology. The main arguments offered to supposedly prove a Short or Low chronology position are in no case decisive and in several cases have been argued in fact to support an alternative Long or High chronology.

Perhaps the most dramatic example of the last is a Cypriot White Slip I bowl that was found on Thera in the late 19th century under the volcanic pumice (Merrillees 2001). The vessel has been lost since at least AD 1922. Bietak argues that because no White Slip I is found in Egypt in a secure context before the 18th Dynasty (though the corpus is in fact quite small, and some sherds from insecure contexts might in fact have been original Second Intermediate Period imports), then this vessel cannot date before the 18th Dynasty, and so the eruption must also date after the beginning

of the 18th Dynasty (e.g., Bietak 2003a, 23–28; Wiener 2001). However, the vessel can be recognized as an early type of White Slip I and is probably of northwestern Cypriot origin (see Manning 1999, 150–92; Manning and Sewell 2002; Manning, Crewe, and Sewell 2006, 482–85; Manning 2007, 118–19). White Slip I appears in west/northwest Cyprus from Late Cypriot IA2 but was not really present in eastern Cyprus (and especially around Enkomi) until (late) Late Cypriot IB; there is a marked regionalism on Cyprus at the start of the Late Bronze Age (Merrillees 1971; Manning 2001; Crewe 2007, esp. p.153), just as in Egypt in the Second Intermediate Period (Bourriau 1997), which lasts into the early 18th Dynasty (Aston 2003, 142). Yet, known Cypriot exports to Egypt in the Late Cypriot I period mainly come from the east. Thus, White Slip I and other new Late Cypriot wares like Base Ring I, largely appear in Egypt only *after* the eastern region adopts them. The Egyptian evidence is therefore at best a partial record of *east* Cypriot fashions at this time and is in no sense a measure of the overall range of Cypriot ceramic history in Late Cypriot IA–IB. In contrast, there is other evidence for LM IA contacts between Thera and northwest Cyprus (Cadogan 1990, 95; Vermeule and Wolsky 1990, 382 and note 76, 394), so we can envisage two very different Cypriot ceramic-regional groupings as represented when we compare the sparse evidence from both the Aegean and Egypt. There is no reason this evidence should be compatible and also no reason to limit early White Slip I to an 18th Dynasty start.

Science Dating

In contrast to the archaeological gridlock, the science-dating situation has become somewhat clearer over the last twenty years.

Radiocarbon

Radiocarbon dates on organic materials of annual growth from contexts buried by the volcanic eruption—like seeds stored in jars when the town of Akrotiri was abandoned—should give ages more or less contemporary with the time humans abandoned the site very shortly before the eruption. These have consistently produced ages indicating a date around one hundred years earlier than the conventional Short chronology date in work by a number of laboratories over several decades (with recent work merely more precise) (see Michael 1976; Michael and Betancourt 1988; Manning 1988, 1990; Manning et al. 2006; Housley et al. 1990; Friedrich, Wagner, and Tauber 1990). The latest study, employing both a large dataset and a coherent sequence of evidence from before, around, and after the time of the Thera eruption to best define the volcanic destruction horizon, offered an age of 1660–1613 BC at 95.4% probability for the volcanic destruction level (with the subrange of 1639–1616 BC the most likely) (Manning et al. 2006).

It is also important to note what is not possible. The original Short chronology date of ca. 1500 BC is simply incompatible with the radiocarbon evidence. Even ignoring the integrated LM IA–LM II sequence and its sophisticated analysis

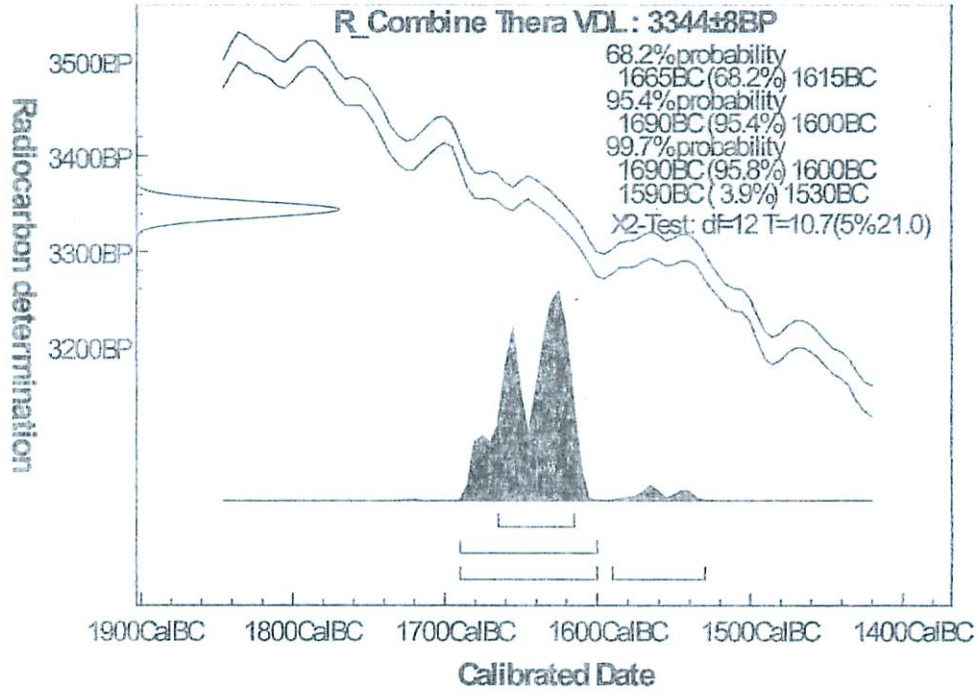

Figure 34.1. Calibrated calendar age probability distribution for the weighted average of the AD2000s analyzed radiocarbon measurements by the Oxford (OxA) and Vienna (VERA) laboratories on short-lived seed samples from the volcanic destruction level at Akrotiri Thera ($n = 13$). Calibration using OxCal and the current IntCal04 data set (calibration curve resolution set at 5: Bronk Ramsey 1995, 2001, 2008; Reimer et al. 2004). For details on the thirteen samples and the individual measurements, see Manning et al. (2006a), supporting online material table S1. As indicated by the χ^2 test (Ward and Wilson 1978), the thirteen samples are all consistent with the hypothesis of representing the same real age at the 95% confidence level. Hence, the weighted average is reasonably the best estimate of the real radiocarbon age (courtesy of the author).

in the Manning et al. (2006a) study, just the high-quality, recently analyzed (measured in the AD 2000s), short-lived data from the volcanic destruction level at Akrotiri by themselves indicate that a date after ca. 1600 BC has less than 5% probability and that a date after ca. 1530 BC has less than a 1% possibility (see figure 34.1).

In response, critics note that plants that grow close (and usually only very close—tens to hundreds of meters) to volcanic vents can take in volcanic (and thus old or depleted) carbon dioxide, which causes them to yield anomalously old (usually very old and highly obvious) apparent radiocarbon ages. Thus, some scholars suggest that or speculate whether this volcanic effect (or something similar) somehow caused an anomaly in the radiocarbon ages for samples from Akrotiri (Wiener 2003, 2007). However, consideration of the very consistent pattern of data from Akrotiri for short-lived samples from the volcanic destruction level (no clear very old ages) and the likely distance from the volcanic vent to the locations where crops were likely growing (several kilometers) both argue against the relevance of the volcanic carbon dioxide effect based on modern case studies of volcanic islands

(e.g., Pasquier-Cardin et al. 1999; Manning et al. 2009). Moreover, samples from sites beyond Thera, where no plausible volcanic effect could apply, indicate a similar age. A recent study (Manning et al. 2006), which employed a large set of radiocarbon evidence from before, during, and after the eruption, considered an analysis that excluded all of the data from Thera/Santorini itself (and so excluded any plausible volcanic effect). This study shows that these non-Santorini data nonetheless clearly indicate the same early age range for the late LM IA period (and therefore for the eruption date). Hence, placing the volcanic destruction level and the late LM IA period in the later 17th century BC seems real and fairly solid.

Another recent study examined an olive sample found in the Minoan pumice on Thera and attempted to date (or wiggle-match) a time-order sequence of segments from this sample out to the bark (or the time of death of the sample) (Friedrich et al. 2006). This placed the time of death (and it was argued the eruption) between 1627 and 1600 BC at 95.4% probability or, considering the range of error possible in their analysis, as wide as 1654–1597 BC also at 95.4% probability (Friedrich et al. 2006, supporting online material table S2). This age appears compatible with the findings from the Akrotiri short-lived samples. The use of olive wood in such a study is unusual as it is not regarded as suitable for tree-ring analysis because clear, visible annual growth rings are not produced; hence, the Friedrich et al. study employed X-ray tomography to try to find the growth increments. However, it is certainly possible that some of the 'rings' identified are not annual or that the count is less accurate than thought. Friedrich et al. considered up to a 50% error in the ring count and found that only modest changes occurred, but a degree of uncertainty undoubtedly exists concerning the reality of the 'ring' count, and replication and further investigation would certainly be desirable.

Worst case? If the 'ring' count is entirely abandoned and one looks only at the indisputable order (from oldest to most recent) across the sample, then a Sequence analysis (employing the data in Friedrich et al. 2006 and the OxCal software with the current IntCal04 radiocarbon calibration curve: Bronk Ramsey 1995, 2001, 2008; Reimer et al. 2004) finds that the last dated segment lies between either 1650 and 1600 BC (57.6% probability) or 1590–1530 BC (37.8% probability), with the most likely 51.7% of the total probability indicating the range 1635–1605 BC. This finding, of course, allows Short chronology proponents to claim that the less likely 37.8% range could allow a date down to around 1530 BC or so. Yes, but it also continues to indicate that the most likely age for the death of this sample is shortly after 1635–1605 BC and thus in line with the other evidence from Thera related to the volcanic eruption (regardless of whether one can really count olive growth 'rings'). (Skeptics and those who prefer a later age for the eruption will also speculate on whether it is certain that the sample was actually killed by the eruption or was not an already-dead section of an olive tree; either assertion is possible, of course, but the coincidence of age range with the other evidence from the Akrotiri volcanic destruction level suggest these assertions probably are not correct.)

Overall, the radiocarbon evidence is fairly clear and indicates a likely date for the eruption of Thera in the later 17th century BC.

Other Science Dating Claims?

In the AD 1980s, analysis of ice cores from Greenland identified acidity peaks that correspond to major volcanism (Hammer, Clausen, and Dansgaard 1980), and it was argued that a volcanic signal ca. 1645 BC could indicate the Thera eruption since this date was compatible with the radiocarbon evidence, and the signal indicated a very large eruption (Hammer et al. 1987). The case was one of coincidence. No positive link was possible between the acid spike and Thera. Thera just happened to be the best-known eruption of the mid-second millennium BC.

Meanwhile, it was observed that tree-ring growth in sensitive locations correlated in some cases with the impacts of major volcanic eruptions. A growth anomaly observed between 1628 and 1626 BC was tentatively identified as perhaps the Thera eruption (LaMarche and Hirschboeck 1984; Baillie and Munro 1988). There was no positive evidence for the specific linkage, but at the time it seemed that an unusual 'package' of evidence indicated a major volcanic eruption around the same time, and the radiocarbon said this could be Thera. A date of 1628/1626 BC seemed a possibility for the Thera eruption. However, these simplistic and sweeping would-be teleconnections and hypotheses were undoubtedly naive (Buckland, Dugmore, and Edwards 1997).

In the subsequent two decades, few new methods have really entered the fray. An attempt to apply luminescence techniques to the dating of the older (Cape Riva) eruption of Santorini, even selecting only quartz to avoid known problems with feldspars, was unsuccessful (Bonde, Murray, and Friedrich 2001). However, it is potentially of importance that recent work has begun on identifying past volcanic eruptions and impacts by employing speleothems, and a stalagmite from Sofular Cave in western Turkey is suggested to have a signal caused by the Santorini/Thera eruption (Frisia et al. 2008, 26; photo of the stalagmite on the front cover of issue no. 2). The dating of the Sofular Cave stalagmite is not yet by itself of the high resolution needed to address the Thera debate independently (contrast the recent higher-resolution record from Grotta di Ernesto in Italy: Frisia et al. 2008:25–26, figure 1), but that dating or similar records may prove useful in the future. A short-lived ^{13}C peak and then a slightly delayed and sustained sulphur response (suggesting increased sulphur levels available for mobilization from surface to subsurface for several decades) is noted in the Sofular Cave starting around ca. 1600 BC (which the authors suggest is consistent with an eruption on Santorini in the late 17th or early 16th century BC). This is an area of research to watch for further developments and for full publications (see e.g. Siklósy et al. 2009).

One other potentially promising avenue of research is dendrochemistry. Pilot work has shown some success linking tree-ring chemistry to major volcanic eruptions (Pearson, Manning, Coleman, and Jarvis 2005; Pearson 2006 and references), and ongoing work may suggest a volcanic association for the ca. 1650 BC growth anomaly in the Aegean dendrochronology (Pearson et al. 2009; Pearson and Manning 2009).

Meanwhile, further research in the subsequent two decades has both changed and clarified the simple initial hypotheses drawn from the ice cores and tree rings. Attempts to identify tiny volcanic glass particles in the ice led first to claims of a positive Thera identification (Hammer et al. 2003) but then to strong criticism, including arguments in one case for an Alaskan volcano instead (Aniakchak) (Keenan 2003; Pearce et al. 2004; Denton and Pearce 2008). Most recently, a date of 1642 ±5 BC has been stated for the one clear major volcanic acidity peak (in all three synchronized Greenland ice cores for the period) in the time span indicated for the Thera eruption by the radiocarbon evidence (Vinther et al. 2006, 2008). Could the ice-core event be Thera? Denton and Pearce (2008) claimed that it could not. However, the careful and considered response of Vinther et al. (2008) makes important reading. It is correct that the chemistry of the volcanic glass is indistinguishable from that from the Aniakchak eruption, but Vinther et al. make a good case that the analyses do not rule out Thera as a source, especially if the clear complexities of the Thera case are considered (they also correctly observe the inappropriateness of Keenan's (2003) t-test approach to this type of analytical situation, remarking that it would also rule out Aniakchak). The most persuasive point is that the tephra arrived several months before the sulphate aerosol in the Greenland ice, typical of major lower-latitude eruptions like Thera and *not* high-latitude eruptions (as noted by Hammer et al. 2003; Vinther et al. 2006).

Thus, an ice-core date of ca. 1642 ±5 BC remains in play (while not established). From the tree-ring side, recent work has found additional years during which growth anomalies plausibly indicate volcanic impacts (Salzer and Hughes 2007). Thera candidates include 1652–1648 BC, 1628–1626 BC, and 1619–1617 BC in the later 17th century BC (contemporary with the age range indicated by radiocarbon for the Thera eruption). Considering the total date range suggested by radiocarbon and conventional archaeology, other possibilities could include 1597 BC, 1544 BC, and 1524 BC. Whether the first or second can be synchronized so as to link with the ice-core evidence is not clear at this time. An extraordinary growth anomaly in the Aegean dendrochronology is dated ca. 1650 +4/−7 BC (Manning et al. 2001), and it is tempting to speculate whether this might be linked with the 1652–1648 BC tree-ring package noted by Salzer and Hughes (2007) and, in turn, whether we might be able to associate this with the ca. 1642 ±5 BC ice-core signal. However, if the Thera eruption is regarded as a lesser signal in the ice-core records, then 1619–1617 BC or 1597 BC could come into play. No other environmental proxy indicates a major volcanic event ca. 1544 BC, so this seems an unlikely association. Wiener (2006) has noted the tree-ring growth anomaly attested in 1524 BC, and, as this is almost at the very margin of the latest possible part of the radiocarbon range and, in reverse, at the top end of the conventional short chronology estimates for the date of eruption, he has suggested this might be Thera in an attempt to keep the short chronology in play. At present no other proxy evidence supports this association.

Thus, with regard to Thera, no clear ice-core and tree-ring tie-in exists as of AD 2009 (contra the situation that seemed to perhaps exist in the AD 1980s, e.g., Hughes

1988). In addition, we have no clear positive evidence, although Vinther et al. (2008) make a reasonable case for seriously considering 1642 ± 5 BC despite recent criticism (and the date may be a little more flexible, even to around 20 years, according to one recent analysis; Muscheler 2009). We simply have several possible candidates.

Conclusions

It might seem that archaeologists and scientists ought to be able to date a very large volcanic eruption less than 4000 years ago. However, although archaeologists in the Aegean can place its relative position in the cultural sequence quite precisely (late in the Late Minoan IA cultural phase), there has been much controversy about the absolute date: later 17th century BC *or* late 16th century BC (or even later for some). The weight of the science-based evidence seems to point to a likely age around a century earlier than archaeologists' best estimate through the AD 1980s. This potential direct contradiction of a long tradition of work by archaeologists has been met with stiff resistance over the last three decades. Acceptance of such a change would involve some significant reworking of the conventional culture-historical synthesis. It would undermine years of work and publications by many leading figures. As a result, it has to be wrong.

What is the right answer? It remains too early to say. Notably, a great deal of radiocarbon work by several laboratories, using samples from Thera, as well as samples *not* from Thera (and thus immune from claims that volcanic carbon dioxide somehow affected the samples on Thera), and from periods before, around, and after the eruption, consistently produces more or less the same result: a date most likely in the later 17th century BC. If so, we may be able to associate some events noted in ice-core and tree-ring records—if a positive connection can ever be established. Based on the ice-core and tree-ring evidence, some major volcano seems to have erupted around 1650 BC, give or take a few years. But which volcano is not known—Vinther et al. (2008) merely argue persuasively that Thera remains a possibility. If this turns out not to be Thera, then the other signals noted earlier could be relevant. The stalagmite from Sofular Cave, and other such records (see for example Siklósy et al. 2009) may also prove useful; this evidence already tends to support the Long or High scenario rather than the Short or Low chronology.

Meanwhile, proponents of the Short Aegean chronology continue vigorously to defend a date in the later 16th century BC (or lower in some cases) and to express skepticism regarding science-dating claims. Those who consider dates in the mid-16th century BC down to ca. 1530 BC can claim to be within the less likely range of the radiocarbon evidence. However, those who argue for dates later than this have entirely to ignore or dismiss the large body of high-quality radiocarbon evidence available. There is no sound justification for this position.

The archaeological and radiocarbon evidence from the next archaeological phase on Crete, Late Minoan IB, is also relevant. The archaeology today indicates a long period based on the recognition of several phases within the overall period (Rutter n.d.), while the radiocarbon evidence is consonant, indicating a date for the end of the phase in the first half of the 15th century BC, but also indicating that this long phase began at least in the mid-16th century BC (placing the Thera eruption at least a little earlier again) (Manning 2009). All of this is another challenge for the Short chronology, whereas it can work very happily with the Long or High chronology and with an overall LM IA to LM II radiocarbon-based chronological framework (Manning et al. 2006).

The date of the great eruption of Thera Santorini thus remains for the present an unsolved question. The arguments on both sides reflect a clear clash of academic cultures and generations.

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CHAPTER 35

THE TROJAN WAR

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THE story of Troy's war with the Greeks is one of the best-known narrative episodes from the Greek and Roman literary tradition. Apart from the scholarly analyses to which the tale is constantly subjected, it has enjoyed many reincarnations in more popular forms—novels, plays, and presentations on television and cinema screens. To the ancient Greeks and Romans, it provided the inspiration for a wide range of artistic representations in the fields of painting, sculpture, poetry, drama, and philosophy. The romance of the story, which began with a love affair, the scale of the conflict, which brought together two allegedly great international powers, the heroic exploits of its main participants, and the final Greek triumph all contribute to the popularity the story enjoyed in the Classical period and continues to enjoy in the Western world today.

In the Classical tradition, the *casus belli* was the abduction of Helen, wife of the Spartan king, Menelaus, by the Trojan prince Paris while he was on a 'goodwill' visit to Sparta. Helen's flight with Paris back to Troy prompted the mustering of a Panhellenic naval expedition under the command of Agamemnon, king of Mycenae, whose mission was to sail to Troy, then ruled by Paris's father, Priam, capture the city, and reclaim the stolen queen. The Greeks encamped on the plains outside Troy and placed the city under siege when the Trojans refused to release Helen. For ten years Troy held out before it fell to the Greeks, who secured entry to the city by the stratagem of the so-called Trojan Horse. Troy was sacked and abandoned, one group of fugitives traveling west with Prince Aeneas, member of a collateral branch of Priam's family. In the version favored by Roman tradition, the refugees resettled in southwestern Italy, where Aeneas became the founder of the Roman nation.

Ancient Greek writers proposed widely varying dates for the Trojan War, ranging from as early as 1334 to as late as the tenth century BC. The 1334 date was proposed by the 4th–3rd century BC historian Duris, tyrant of Samos, for whom the

war occurred 1,000 years before Alexander's arrival on the site of Troy (*FGrH* 76 F41). The historian Herodotus, writing in the fifth century, dated the war 800 years before his time (i.e., early in the thirteenth century) (2.145). The third-century Greek geographer Eratosthenes believed that it took place 407 years before the first Olympiad (i.e., 1183) (*FGrH* 241 F1, 244 F61). This last date was the one most favored in the Hellenistic period. However, although they differed on the war's actual date, the ancient writers all agreed in assigning it to Greece's prehistoric period, many generations before the appearance of the first written records (after the Linear B script) in the Greek world. In modern terms, the period to which they assigned the war belongs to the last century (or a little earlier in the case of Duris) of the Late Bronze Age.

In the interval between the war and the earliest written records of it, traditions about the conflict were kept alive and orally transmitted by a succession of storytellers, no doubt like the bards and minstrels who, according to Homer, entertained the courts of Mycenaean kings and noblemen (*Odyssey* 9.5–11). By far the most famous version of the tale is that narrated by Homer in the *Iliad*. However, the Trojan War story must already have been told many times by many generations of bards and minstrels before Homer first recited his poem in the late eighth or early seventh century. Indeed, much of our information about events associated with the war, including the abduction of Helen, the stratagem of the Trojan Horse, and the fall of Troy, comes not from Homer but from other sources. The most notable of these are the remains of a group of poems making up the so-called Epic Cycle. These postdate the *Iliad* but are probably no later than the seventh or early sixth century. They include works such as the *Cypria*, which deals with the seduction of Helen, the *Little Iliad*, which tells the story of the Trojan Horse, and the *Iliu Persis* ('Sack of Troy'), which describes the capture and destruction of the city by the Greeks. Though only small fragments of these works survive, they clearly reflect stories of the war that predate Homer's own narrative.

Homer himself refers only in passing to some of the war's best-known episodes and in the *Iliad* makes not one single mention of the Trojan horse. He has no wish to repeat all of the details of an already well-known story. Instead, he confines his attention to the last weeks of the ten-year conflict—fifty-one days to be precise—and most of his account is limited to just six days, four days of fighting divided by two days of truce.

The chief theme of his poem is the wrath of the Greek hero Achilles, which was directed initially against Agamemnon for commandeering his favorite slave girl, Chryseis, and finally against the Trojan prince Hektor, who has killed his beloved friend Patroklos. Achilles' all-consuming desire for revenge is not satisfied until he has met and slaughtered Hektor in hand-to-hand combat and desecrated his body by dragging it back to his tent behind his chariot. The *Iliad* ends with Hektor's funeral rites. It thus stops short of an account of the Greeks' final victory and the sack of Troy, though the city's fall is foreshadowed a number of times throughout the poem. Homer is less concerned with the outcome of the war than with the range of human qualities and emotions the conflict reveals, as well as the personal

triumphs and tragedies to which it gives rise. In this respect, no distinction is drawn between those who fought on the Greek side and those who fought on the Trojan. All were united in both a common culture and their adherence to a common set of ideals and values.

We should not lose sight of the fact that Homer was a poet, not a historian. Moreover, it does him an injustice to assess the merits of his composition on the basis of whether it reflects historical fact. Even so, the ancient commentators had no doubt about the fundamental truth of the *Iliad* and of the Trojan War tradition in general. Nonetheless, they were sometimes skeptical about various aspects of the tradition, particularly as Homer presented it. Herodotus, for example, accepted the story the Egyptian priests told him—that Helen had never reached Troy (2.112–18). Rather, she had been detained in Egypt, whither the ship in which she and Paris were traveling had been blown by violent winds. The Egyptian king, Proteus, had held her in custody until her husband, Menelaus, could rescue her. When later challenged by the Greeks to hand Helen over, the Trojans declared that they could not do so because she was not in Troy. Homer well knew the truth, Herodotus declares, but ignored it because it did not suit his epic theme. Herodotus's younger contemporary Thucydides also had no doubts about the basic historicity of the Greek-Trojan conflict and cited Homer as its main source (1.10). However, he believed that Homer, like other reciters of tales, was prone to exaggeration (2.41).

According to Thucydides, Homer set the size of the Greek fleet at 1,200 ships. This is a rounded-off figure, for the precise total obtained by adding together all of the vessels listed in Homer's 'Greek Catalogue of Ships' (*Iliad* 2.484–760) is actually 1,186. A fleet of this size is inconceivable in a Bronze Age context. Late Bronze Age fleets may have contained no more than a dozen ships at most. We know, for example, that around the time the Trojan War allegedly took place, a fleet of seven ships was sufficient to attack and inflict severe damage on the Syrian coastal city of Ugarit (Nougayrol et al. 1968, 87–89n24).

This is consistent with what the *Iliad* tells us about a first Trojan War in the days when Priam's father, Laomedon, ruled Troy. In this war, the Greek leader was Herakles, who captured and sacked Troy with just six ships (*Iliad* 5.640–42) and apparently in a much shorter time than the ten-year siege of the 'second' Trojan War. A naval-based military operation on this scale is much more feasible in a Bronze Age context than one involving an armada of 1,186 ships. Thucydides makes some attempt to rationalize Homer's figures by suggesting that the actual number of combatants on board the fleet may not have been particularly large and that the siege continued for ten years because the majority of the Greek forces had to be deployed on plundering and crop-production activities to ensure adequate provisioning for the actual besiegers (1.11).

What of scholarship today? Making allowances for a conflict conceived on an 'epic' scale and magnified by successive generations of bards for the entertainment of their audiences, have modern scholars been able to find a kernel of historical truth in the Trojan War tradition? There is now little doubt that the site of Hisarlık, which the Classical Greeks called Ilion ('Troy VIII') and the Romans Ilium ('Troy

IX'), was the setting Homer used for his account of the Trojan War. Furthermore, it is commonly assumed that one of Ilion's Late Bronze Age predecessors ('Troy VI' or 'Troy VII') was the *actual* setting of a historical conflict or conflicts that gave rise to the Greek tradition of a Trojan War.

Bronze Age settlement at Troy reached its peak in the Troy VI period, dated on archaeological grounds from ca. 1700 to the early thirteenth century BC (see Mountjoy 1999). The material remains of this level are not inconsistent with Homer's description of Priam's Troy—though the correspondence does not extend beyond a few general features. The final sublevel of Troy VI (VIh) suffered violent destruction. A date of ca. 1280 BC for this destruction would fit well with Herodotus's date of the Trojan War. There is some evidence to support the conclusion that Troy VIh was destroyed by human agency, though it is not sufficient to rule out destruction by earthquake.

Among the most important results produced by Manfred Korfmann's work at Hisarlık is the identification of a Late Bronze Age lower settlement attached to the citadel mound. Korfmann's excavations, conducted between 1988 and 2005, appear to have increased tenfold the known area occupied by Troy, from some 20,000 square meters (the citadel on its own) to approximately 200,000 square meters (see Korfmann et al. 2001; Korfmann 2006). Such a dramatic increase in the city's size has presumably laid to rest the concerns of Homeric literalists (beginning with Heinrich Schliemann), who have found it difficult to reconcile the previously known area of Troy with the Homeric representation of a city that took a force of tens of thousands of Greeks ten years to conquer.

Korfmann's excavations (which have been subject to criticism by some scholars) indicate that Troy was a much more substantial city than had previously been evident. Its population at its peak in the Troy VI period is now estimated to have been somewhere between 4,000 and 10,000. The city was still not large by ancient Near Eastern standards, but if well fortified, as it clearly was, it could have resisted a large besieging force for a considerable period of time—but probably only for a matter of months, not years. Walled cities attacked by the contemporary Hittites might sometimes hold out for six months against their besiegers, and the investment of such cities could in some instances have strained the resources of the besiegers almost as much as those of the besieged.

There is some validity in Thucydides' claim that a much larger force than the one directly employed for the siege of Troy was necessary to ensure that the besiegers were adequately provisioned. However, the notion of a protracted siege lasting ten years is simply out of the question. A more realistic conclusion would be that a city like the Troy that Korfmann has now revealed may have been subject to a siege of up to six months (or not much more) by an attacking force of around ten thousand men. Some of the attackers may have arrived in ships, while others were very likely land-based forces, recruited in some cases from local regions and populations allied with or subject to the attackers.

Do Hittite sources provide any answers to the question of whether there really was a Trojan War? The proposed identification of the Late Bronze Age states Wilusa/

Wilusiya and Taruisa in Hittite texts with Homer's (W)ilios and Troia has led to much inconclusive debate among scholars since the Swiss philologist Emil Forrer first suggested the equivalence in the 1930s. However, recent studies on the political geography of western Anatolia have considerably strengthened the case for locating Wilus(iy)a and Taruisa in northwestern Anatolia, in the region later called the Troad (see Starke 1997; Hawkins 1998). These studies increase the likelihood that Wilus(iy)a/Taruisa was the historical prototype of Homer's (W)ilios/Troy. The significance of the equation is that if it is valid, Hittite texts do provide us with a few scraps of information about Troy's (i.e., Wilusa's) history during the Late Bronze Age (see Güterbock 1986; Bryce 2006, 107–12, 182–86). It was for a time a subject kingdom of the Hittite empire and perhaps for this reason became embroiled in disputes and uprisings, probably involving pro- and anti-Hittite internal factions, as well as external forces.

Directly or indirectly, Mycenaean Greeks may have become involved in these conflicts. Few scholars now doubt that the term 'Ahhiyawa' was used in Hittite texts to refer to the Mycenaeans, sometimes called Achaeans in the Homeric poems. A specific king of Ahhiyawa had established control over Milawata (Classical Miletus) on the southwestern Aegean coast of Anatolia by the end of the thirteenth century, and he may well have used Milawata as a base for the further expansion of his influence and power throughout the western Anatolian coastal regions. In the inappropriately named 'Tawagalawa letter,' one of the best known of the 'Ahhiyawa documents' in the Hittite archives, the Hittite king, probably Hattusili III (ca. 1267–1237 BC), hints at the prospect of war over Wilusa with his Ahhiyawan counterpart (see Güterbock 1986, 37) and complains of the latter's support of insurrectionist activity in the area.

Another well-known letter, the so-called Milawata letter, informs us that Wilusa's king Walmu had been removed from his throne and sought refuge with his Hittite overlord, on this occasion probably Hattusili's son and successor, Tudhaliya IV. The Hittite king, author of the letter, is making arrangements with the addressee, unnamed in the letter's fragmentary remains but probably the king of the large nearby state, Mira, for Walmu's restoration (see Bryce 2005, 306–308). To judge from the fragmentary Hittite records that refer to it, Wilusa may well have suffered periods of political and military turbulence, like all other states in the region. In addition, it is not at all unlikely that a territorially ambitious Ahhiyawan/Mycenaean kingdom, which had already established a base on the Anatolian mainland, turned predatory eyes on the northern Anatolian kingdom—acting in some instances with the support of local insurgents. However, it is a major step from there to assert that we have in the small number of relevant Hittite documents evidence for the historical reality of the Trojan War tradition.

Warfare that resulted in the capture and sacking of cities was a normal state of affairs in the history of the Late Bronze Age, and the likelihood is that there were many 'wars' involving the people of Wilusa and outside attackers, the latter very likely including Greeks. Of course, some such wars may have been little more than small-scale raids designed to plunder merchandise as it was arriving in or departing

from the city. Still, this does not rule out the possibility of a substantial and protracted conflict between northwestern Anatolians and Ahhiyawan/Mycenaean Greeks that provided the genesis of the Trojan War tradition, best known from Homer's version of it. Korfmann himself has argued such a case, and one of his staunchest supporters, J. Latacz (2004), has done so at greater length. However, the historical reality of a single, discrete conflict on a scale and of a duration consistent with the epic tale has yet to established. My own view is that the tale told by Homer and by generations of bards before him is based on an accumulation of stories of conflict that span perhaps several centuries and came to be distilled into a single episode supposedly lasting for ten years and involving a cast of many thousands. In *this* respect, there may well be a factual basis, or indeed many factual bases, for the story of the Trojan War.

Hittite documentary sources provide no close parallels for what in Greek tradition was the fundamental cause of the Trojan War—the abduction of a Greek queen by a foreign prince. However, Hittite kings were certainly prepared to go to war with other rulers who abducted their subjects or provided refuge for them when they fled Hittite authority. On one occasion, too, the Hittite king declared war on Egypt when his son was allegedly murdered by Egyptian agents while on his way to Egypt to marry the pharaoh's widow (see Bryce 2005, 180–83). The abduction no less than the murder of a member of a royal family by representatives of a foreign kingdom might well have provided—in the real as in the legendary world—the catalyst for conflict between two kingdoms. There is no need to find a more prosaic explanation for the Trojan War, as some scholars have done, by proposing (for example) a squabble over fishing rights in the Hellespont (Dardanelles) or a contest for control over the waterways leading from the Aegean to the Black Sea.

Due largely to the Homeric version of Troy's conflict with Greece, the Trojan War became firmly embedded in legendary tradition and provided a major source of inspiration for many generations of writers and artists in the Classical and later worlds. It served other purposes as well. Herodotus claims that the Persians dated their hostility toward Greece to the time of Troy's fall and reports (7.43) that just before crossing the Hellespont for his invasion of the Greek mainland in 480, the Persian king Xerxes ascended Troy's citadel and was told the whole story of what had happened there; he then sacrificed a thousand oxen to the goddess Athena of Ilion and ordered his priests to offer libations to the heroes of the Trojan War.

Xerxes would have been fully aware of the political value of a visit to Troy at the beginning of his Greek campaign, and this was no doubt reflected in the symbolic acts he performed on the site. Quite possibly he *now* sought to represent himself as the avenger, finally, of Troy's destruction. Nevertheless, there is no suggestion in any of our sources that a desire to take vengeance on the Greeks for what they had done to Troy figured among the reasons for the Persian campaign against Greece, let alone provided a fundamental cause for it.

In 334, Alexander the Great visited Troy immediately after landing on Asian soil. Here he paid homage to the goddess Athena and to the heroes of the Trojan War. This was in effect a response to the similar acts Xerxes had performed on the

same site 150 years earlier. The situation was now reversed. Alexander's visit to Troy marked the beginning of his campaign against the Persian empire, as Xerxes' visit had marked the beginning of his campaign against Greece. For both Alexander and Xerxes, the rites they performed on the site of the alleged Trojan War had important symbolic significance and made clear political statements.

The Trojan War tradition gained a new lease on life in the last decades of the first century BC, when Vergil composed an epic poem that used the sack of Troy as its starting point. Vergil's poem, the *Aeneid*, shifts the focus from the main characters of the *Iliad* to the minor Trojan prince Aeneas. The poem has to do with Aeneas's flight from the burning city, his subsequent travels, and his final settlement in Italy, where he founded the Roman nation. In fact, only one of the twelve books of the *Aeneid* is devoted to the Trojan War. This is Book II, which contains a number of well-known episodes of the war preserved in Greek tradition but not found in the *Iliad*. Notable among these are the stories of the Trojan Horse and the sack of Troy, as well as a description of the murder of Priam. However, there is no doubt that Homer's poem provided the basic inspiration for the Vergilian composition. Even so, the *Aeneid*'s main purpose was a political one. It was intended to justify the extraordinary status that Rome's 'first citizen,' Augustus, enjoyed by depicting the emperor as the lineal descendant of Aeneas and the founder of a new golden age, one whose coming had been foretold by destiny back in the time of Aeneas's arrival in his promised land.

We have referred to Xerxes' and Alexander's visits to Troy in 480 and 334, respectively, and the symbolic and political significance of these visits. Ten years after his conquest of Constantinople in 1453, the Ottoman sultan Mehmet II also came to Troy. There he declared that, in capturing the Byzantine Greek capital, he had defeated the descendants of those responsible for the destruction of Troy; they had at last paid the debt they owed to the people of Asia (Vermeule 1995, 447–48).

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