5 Stonemasons and Craft Mobility in the Bronze Age Eastern Mediterranean

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Abstract

This chapter considers the evidence for craft mobility and cultural learning amongst stonemasons in the Bronze Age eastern Mediterranean. It draws on a range of cross-cultural comparative evidence, as well as placing particular emphasis on case studies from Egypt and the Aegean in the 3rd and 2nd millennium BC.

Introduction

Stone-working is one of the oldest craft traditions in human history and also one of the most closely studied. The latter interest is in part pragmatic, as stone survives extremely well in archaeological contexts, can sometimes be provenanced and demands subtractive working practices that often leave clear signatures of different technical traditions and choices. This chapter explores patterns of craft mobility and cultural learning associated with stone masonry in the Bronze Age eastern Mediterranean. In particular, we want to argue that three topics should loom larger, both empirically and theoretically, than they currently do in most current analyses of stone-based crafts. First, closer attention should be paid to the learning conditions that underpin stoneworkers' knowledge in different parts of the Bronze Age eastern Mediterranean. What are the wider implications of the apprenticeship modes by which stone-workers typically learn their craft and of stone-workers' often high levels of geographic mobility? How much do these features vary in different contexts, time periods or regions? Second, what particular social and

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political circumstances affect the way stone-working specialists are deployed across or beyond a given polity, and what consequences does this have for horizontal exchanges of craft knowledge? Third and related to the first two, we need to give more dedicated attention to the role of 'bottleneck' transmission episodes – for instance, when the number of people carrying a particular stone-working tradition is dramatically reduced for one reason or another – as this underlying demographic crunch is often accompanied by a physical diaspora and has important consequences for the disappearance or spread of crafting know-how.

We begin with a general discussion of the evidence for how stone-workers learn their craft, before briefly outlining the evidence for mobile stone-workers, both within and among different states, during the 3rd and 2nd millennia BC. Thereafter, discussion shifts to several case studies from Egypt and the Aegean that facilitate more detailed empirical study of these topics. For Egypt, there is a vast array of potentially relevant information, but we choose to focus on the challenges associated with stone procurement at source, and consider two different Egyptian quarries that emphasise craft mobility at diverse spatial scales and temporal rhythms. One of these involved massive project-driven procurement of a prestige stone destined for the Old Kingdom pyramid complexes, namely basalt from Widan el-Faras in the northern Faiyum. Transforming the quarry landscape over a period of 250 years between the third and fifth Dynasties of the Old Kingdom (c.2700–2460 BC), well-preserved archaeological traces through stone tools, object rough-outs, camps and standing infrastructure allow us to examine knowledge transfer from different organisational angles. For instance, from top-down deployment of specialists via royal state-run workshops, to an altogether more loosely based, bottom-up knowledge-sharing among kin-based groups of regional and local stonemasons. A second quarry landscape, for making grinding stones of silicified sandstone, on the West Bank of the Nile at Aswan, is less well known than the granite extraction site nearby on the east bank, but offers a useful vantage on the other end of the spatial spectrum, where everyday priorities were more mundane, but extremely consistent long-term use ensured a highly local, multi-generational tradition of craft learning that was largely distinct from state-organised and more thoroughly institutionalised enterprises.

Turning thereafter to the 2nd millennium BC Aegean, a whole spectrum of Minoan stone-working activity allows us to explore interesting similarities and contrasts with the Egyptian evidence. However, the focus in this case is less exclusively on comparing quarry crews and more on the world of elite artisans attached to Minoan and Mycenaean palace complexes. Particularly interesting are the clear mason's marks on the sides of the finest architectural blocks found in Cretan palaces, and what this tells us about the organisation

and deployment of elite craftspeople in Minoan Crete and elsewhere. Many different interpretations have been offered for the significance of these marks, but we situate them very clearly within a wider cross-cultural pattern of specialist practice in ashlar masonry.[1] The Aegean case study emphasises the importance of a late 15th- and early 14th-century BC phase when the epicentre of elite stone-working traditions shifted from Crete to the Mycenaean mainland. Here, even in the absence of written records to this effect, we can make a reasonable case for the physical relocation of a limited number of Cretan craft specialists, followed by the reprioritisation of Aegean fine stone-working skills to transformed political agendas. A later if more hotly debated phase of possible technical exchange is potentially visible in some of the perceived Hittite influences on Mycenaean stone masonry, and it is worth comparing this episode to the earlier Minoan and Mycenaean example. However, without some sense of how individual stone-workers acquired, maintained and shared technical knowledge, such observations of technological diffusion would mean very little, and so it is first worth adopting a more cross-cultural perspective on how stone-working knowledge is often transmitted.

Contexts for Learning

The operational sequence behind stone-working, from extraction at source to final crafting, involves strategic choices on the part of the artisans involved – for example, anticipating the purpose of the end-user(s), the scale of the enterprise, the working affordances of the raw material, the availability of specific tools and the degree of acceptable risk to worker, tools and material. However, this extended creative process not only reflects conscious choice, but also less deliberate reproduction of one or more received technological traditions. Archaeologists have already devoted much attention to the issue of craft specialisation with useful results (e.g. Brumfiel and Earle 1987; Costin 1991; Shaw 2012). In what follows, however, we wish to emphasise three features that strongly affect technological traditions but that have as yet received only passing attention: (a) the need for long periods of adolescent apprenticeship, (b) the crucial role played by formal and informal 'communities of practice', and (c) the particular mobility often exhibited by stone-workers in comparison to other craft

[1] Ashlar refers to stone shaped into rectangular blocks with squared off edges and flat faces. It contrasts with building in more irregular blocks known as rubble masonry.

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specialists. With respect to the first of these, it is worth stressing that, prior to the mass production of technical handbooks, specialised crafting skills were passed on via a time-consuming combination of personal experience and various kinds of face-to-face learning that typically took the form of apprenticeship (e.g. Ericsson et al. 1993; Gosselain 2000; Epstein 2004; Cianciolo et al. 2006). For example, in medieval Europe, four to seven years of apprenticeship were usually deemed necessary for someone to become a master stonemason (see also Johns 1904, 182; Westermann 1914), although different sub-skills (e.g. cutting stone, building walls, drilling things, carving decorative surfaces) might require different lengths of time, and there were always particular routes of sub-specialisation (Knoop and Jones 1932; Prak 2011, 398–403). Young children, almost always boys in documented cases of large-scale stone-working, were mentored by adult stone-working experts who (a) spelt out certain technical acts in an explicit way (i.e. via orally communicated recipes, familiar mantras, etc.) (b) encouraged them to physically imitate other technical gestures (that could not otherwise be explained verbally), and (c) offered them a context in which to develop further personal tacit knowledge by trial and error (Shelby 1970; Wagner and Sternberg 1985).

However, while one-to-one master–apprentice relationships are very important for the above learning experience, a second point to emphasise is the role of wider communities of stone-working practice. Such communities can vary tremendously in terms of their size, physical location, make-up and degree of institutionalisation. In some instances, it is family and kin-based groups that play the crucial role, while in others the collective is a fraternity, building lodge and/or craft guild, with its own rules of conduct, closed membership and sometimes religious affiliations (e.g. Prak 2011 and also Grenne et al., 2008 regarding millstone quarrying in Norway). Quarries and building sites, marginal landscapes and urban metropoleis all play a role as places where such corporate consciousness and knowledge-sharing develops. Sometimes the groups coalesce only temporarily but their sense of purpose is powerfully reinforced by the demands of a single mega-project, while in other situations the tempo of work is slower but more even, with considerable continuity over several generations or more. Regardless, stone-working collectives may not only have internal hierarchies but often fit into broader craft hierarchies as well. In the Bronze Age eastern Mediterranean, both archaeological and documentary evidence (see below) lead us to anticipate clear gradations between (a) highly specialised stone-workers with carefully monitored working conditions (e.g. attached to royal courts, upper elite estates or temple complexes), (b) apprentices on

a similar track but not yet given the same responsibilities, (c) all-purpose stonemasons who might be involved in a variety of different kinds of work and (d) larger local labour forces (see also Knoop and Jones 1932, 355). We seek to identify some of these different cases and their impacts in the case studies below.

We will not address the flow of raw materials and finished stone products here in any detail but it is also worth stressing that, while most stone resources were deployed within a few kilometres of where they were extracted, others could travel hundreds of kilometres, and cross political borders, because of the functional, symbolic or aesthetic values ascribed to them (e.g. Michel 1992; Moorey 1994, 21–59; Chanut 2000, 170–3; Bevan 2007; Marcus 2007, 141–50; Bloxam and Heldal 2008, to name but a few Bronze Age examples). Moreover, both the people and equipment required for stone-working are necessarily mobile, over different spatial scales (e.g. among local communities, across large states or between them), at different temporal rhythms (daily, seasonal, project-driven) and for a variety of reasons. Hence, a third major feature of stone-working, in the light of cross-cultural evidence, is the fact that we should expect more persistent patterns of mobility and itinerant lifestyles than in many other crafts. For example, 19th-century English stonemasons travelled so frequently that unions of masons would underwrite each other's sustenance and lodging at local inns across the country (Hobsbawn 1951; also Prak 2011). The tempo of long-running stone construction is also often very uneven, demanding very variable numbers of specialist stone-workers, journeyman assistants and young apprentices at different times. For example, in England during the summer months of 1253, 130 stonemasons and 220 assistants were employed at Westminster Abbey, but this number was halved by September of the same year as most of the assistants departed for other work (probably for the harvest; Prak 2011, 386–7; see also Norwegian examples in Storemyr and Heldal 2002; Grenne et al. 2008). Both a cause and effect of such uneven tempos was the need for geographically flexible working practices.

In the Bronze Age Mediterranean, our view of these patterns of mobility is dominated by documentary sources promulgated by palaces (and to a lesser extent temples) and it is perhaps unsurprising that the most obvious examples are therefore of specialists who travelled partially or wholly because they were made to do so. For example, at one extreme of scale are forced population displacements, such as those that saw numerous captured masons and ordinary labourers put to work on building projects in Achaemenid Persia (Nylander 1972) and for which there are also Bronze

Age hints (Zaccagnini 1983, 257). At a smaller scale, we can point to good Bronze Age documentary evidence for the gifting of individual specialists between royal courts. Physicians and entertainers were particularly sought after, but the need for a sculptor to make new statues is invoked in at least two separate letters, one from the Babylonian king to Hittite Anatolia, the other from the Ugaritan king to Egypt as a reason for sending an especially skilled artisan from one court to another (Zaccagnini 1983, 253; Lackenbacher 1995; Moorey 2001). Another tantalising 13th-century BC case may be the stone moulds for Hittite-style trapezoidal shields at Qantir-Piramesse which might simply imply local production of foreign objects, but could also reflect the redeployment of foreign specialists (Shaw 2012, 116–17; van Dijk 2000, 300). Such artisans were often kept at foreign courts for months or years longer than initially proposed, with many letters complaining (apparently in vain) about their delayed return.

Within states, there was also concentration of specialised labour in urban centres, particularly at the capital, and this sometimes left a comparative dearth of such knowledge in the provinces (Zaccagnini 1983, 248) and thereby provided a useful opportunity for royal patronage. For example, an Old Kingdom letter of protest from a quarry expedition commander of the 'necropolis masons' at Tura specifies the 'royal residence' as the source of payment, supplies and instructions (Eyre 1987, 15) and we come back to other clearly dendritic redeployments within Egypt and Minoan Crete further below.

Even so, we should be slightly cautious about treating these top-down claims to total control of specialist labour at face value. For example, the rhetoric of specialists-as-chattels, in the Amarna Letters and elsewhere, runs in clear parallel to a similar diplomatic choreography of merchants-as-ambassadors, kingdoms-as-personal estates and commerce-as-gifts (e.g. Bevan 2010a, 38–46). In many instances, there are strong hints that this was deliberately simplifying more complex realities and varying degrees of centralised power. In contrast, more voluntary mobility, both of the hyper-skilled and the ordinary stonemason, is harder to unpick in Bronze Age contexts. Some hints are offered by personal names attesting to father and son teams of Syrian craftsmen in Egypt and later Aramaic texts in the Wadi Hammamat greywacke quarries imply the presence of non-Egyptian stone-workers (Couyat and Montet 1912; Simpson 1959, 35–6; Moorey 2001, 9). Furthermore, both formal records and graffiti found along trade routes in the Eastern Desert and Lower Nubia refer to specialist prospectors and gemstone importers called the 'Sementiou' (Yoyotte 1975, 44–55). The idea of 'travelling tinkers' or nomadic family groups with craft skills has been

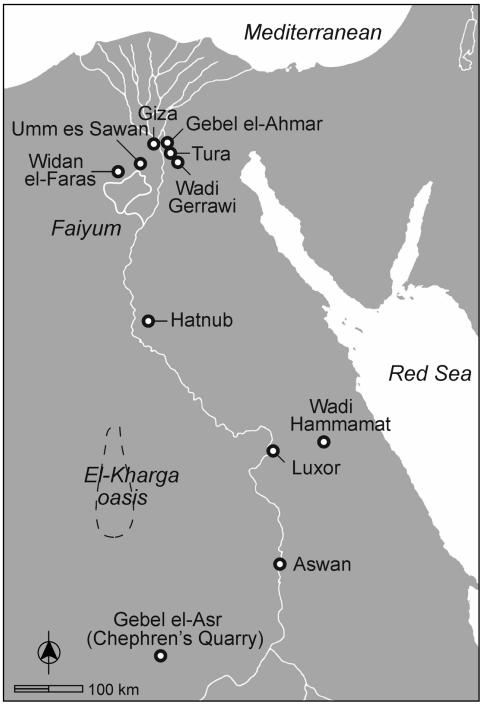

Figure 5.1 Map of Egypt showing the sites mentioned in the text (drawn by author).

one of many interpretations of a Middle Bronze Age tomb painting in Beni Hassan depicting a group of southern Levantine 'Amu' who are probably traversing a regular trade route connected with the extraction of galena and other resources in the Eastern Desert (Newberry 1893, 69, pls. xvii, xxviii, xxx, xxxi; Goedicke 1984; Kessler 1987; Kamrin 1999; Moorey 2001, 11; Bloxam 2006, 295–6). The simple conclusion to draw is that we always need to think of the elite specialists with reference to a wider, often quite varied pool of crafting knowledge and practice.

Egyptian Stone-Working: 3rd–2nd Millennium BC

In what follows, we begin some more empirically based discussion of the above issues by looking at stone-working at the source, via a comparative analysis of quarries that were at the epicentre of large-scale resource procurement in Egypt during the 3rd and 2nd millennia BC (Harrell and Brown 1994; Harrell and Bown 1995; Bloxam and Storemyr 2002; Bloxam et al. 2007; Shaw et al. 2010). Although the major focus will be on Widan el-Faras

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(basalt) in the northern Faiyum and the Aswan West Bank (silicified sandstone) we also make mention of other important sources such as Gebel el-Asr (Chephren gneiss) in Lower Nubia (Figure 5.1). Basalt, silicified sandstone and Chephren gneiss were all highly sought-after hard stones used for ornamental objects (e.g. obelisks, statuary), building stone (ashlar blocks, other masonry) and certain utilitarian purposes (grinding stones, tools). They were also channelled to a range of depositional contexts locally, regionally and internationally. Because the sources of these stones span a wide geographical area, we have an opportunity to analyse contact at source between mobile stonemasons from a range of spatial scales and temporal rhythms.

The study of quarries has moved in particularly fruitful directions in recent years, and now addresses not only the technological specifics of resource extraction but also a wider social and organisational context (Bradley and Edmonds 1993; Cooney 1998; Bloxam et al. 2009; Shaw et al. 2010; Bloxam 2011a; Hamilton et al. 2011; Dickinson 2014). First, it is worth emphasising that quarries are rarely singular archaeological 'sites' but rather comprise whole 'landscapes', transformed by exploitative practices that ebb and flow in relation to how sought-after a particular stone's properties were at a given time (see for instance Cooney 1999; Bloxam et al. 2007; Heldal 2009). These properties may relate to functional uses of the stone for cutting or grinding, aesthetic qualities such as colour and texture and/or symbolic associations with particular sources and religious ideologies. Some sources can also be important meeting places that draw in groups from a wide geographical area and are maintained over several generations. As Mark Edmonds (1999, 47–8) has pointed out for European Neolithic contexts, the maintenance and transmission of stone-working traditions is often mediated at the stone source through successive generations of local people, and hence by certain forms of unbroken cultural memory, including the multi-generational preservation of craft knowledge (for further enlightening Australian examples, see also Taçon 1991; McBryde 1997; Fullagar and Head 1999; Brumm 2010, 191–3).

Stone-worker mobility and knowledge exchange can be assessed through several types of quarry evidence: for instance, both changing extraction techniques and altered logistics of subsequent transport. The suite of stone tools found at quarries are particularly important portable objects to consider in this regard, as they can be brought in from often distant sources, often make themselves visible to the archaeologists as artefacts that are geologically incompatible with the local area, and thereby inform us about an organisational framework of links between stone-workers and certain strategic resources (for more discussion of stone tool circulation between

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kin-groups see Bradley and Edmonds 1993, 96; Cooney 1998, 108–18; 1999, 49–51; Edmonds 1999, 47–8; Bradley 2000, 86–7; Boivin 2004, 10–16; Bloxam et al. 2014; Bloxam 2015). The construction of purpose-built roads and other logistical apparatus may also have encouraged interactions among otherwise distinct cohorts of specialists, for instance, between boatmen, road-builders and stonemasons. Marks made on quarried blocks by individuals or teams of stone-workers and control notes made by scribes illuminate how stone sometimes passed through several distinct groups on its way from quarry to construction site, thus creating other potential spheres of interaction (see Arnold 1990). In addition, it is worth considering the engravings on rocks near quarries that socialised these landscapes in important, long-term ways (Taçon 1991, 195; 1994; Bradley 2000, 38–9; Boivin 2004; Bloxam 2011a, 156–61), and might range from figurative imagery to specialist marks to narrative inscriptions. Although these rarely enlighten us directly about practice, the occurrence of names and titles in a quarrying context are useful indicators about evolving roles, hierarchies, kin-groups, project-driven expeditions and blends of local and regional religious practice, amongst other things. Turning to the Egyptian case-study quarries considered below, these have been chosen both because they offer examples of this full spectrum of possible evidence, and because they capture a range of scales of mobility and knowledge exchange, spanning: (1) localised deployments in quarries where long-term craft traditions in stone-working already exist; (2) the conditions arising from shorter term mega-projects.

Aswan West Bank

The Aswan and First Cataract region is perhaps most famous as a centre of granite quarrying in pharaonic and later periods, with major extraction sites located on east bank of the Nile. Less talked about are the silicified sandstone (sometimes called 'quartzite') quarries along the west bank at Aswan. This was one of two major Egyptian sources of silicified sandstone, with the other located at Gebel el-Ahmar and far less amenable to modern study as it lies within modern Cairo. Here we examine the extent to which changes in the consumption of 'ornamental' products (by which we mean objects such as obelisks and statuary, but not architecture or tools) at Aswan may have interacted with a pre-existing very long-term tradition of stone tool production in the area. Relatively good preservation of the quarry landscape has allowed us to trace these different types of exploitation along the Aswan West Bank and how they have changed over time (for more detailed

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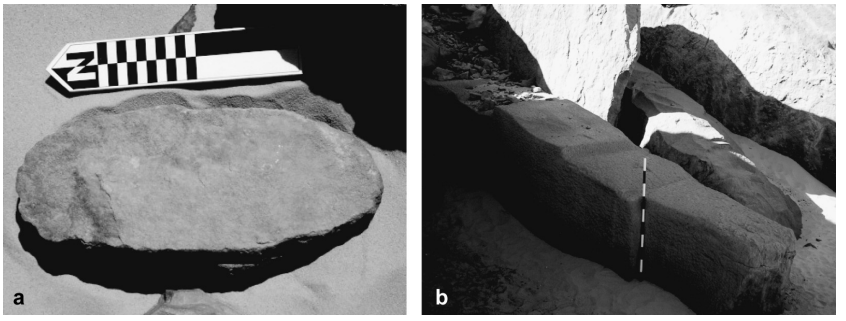

Figure 5.2 Aswan West Bank silicified sandstone quarries: (a) a typical oval grinding stone, and (b) truncated New Kingdom obelisk(?) still partially attached to bedrock (author's photo).

description, see Bloxam et al. 2007). The properties of silicified sandstone made it highly sought-after from a very early stage as a key material for tools and grinding stones (Figure 5.2a). The oldest phases of production, from the Lower Palaeolithic tool makers (300+kya) to Predynastic (late 4th millennium BC) grinding stone producers, are usually located around the bases of the *gebel* landforms where naturally loosened boulders could be found (see Heldal and Storemyr 2007; Heldal 2009, 136–42; for more detailed description).

In addition, from the Old Kingdom onwards, silicified sandstone was also quarried in a more formal way for large ornamental objects, even if most early traces have been obliterated by later workings. On an aesthetic level, the stone's glittering properties gave it symbolic value as 'the most solar of stones', leading to certain discrete episodes of large-scale exploitation for ornamental objects when royal religious and ideological change was linked with the solar cults (Kozloff et al. 1992, 76, 110; Quirke 2001, 76; Bloxam et al. 2007, 38–9, 42–3). The New Kingdom ornamental quarries are perhaps the most prominent surviving examples of this, with unfinished objects such as truncated obelisks often remaining attached to bedrock in the quarry and dateable by associated ceramics and inscriptions (Figure 5.2b; Heldal and Storemyr 2007, 102–22; Bloxam et al. 2007).

The basic stone tools and methods used to split and shape already loose boulders into grinding stones at Aswan did not change significantly from the Late Palaeolithic into much later periods, with stone tools used to split and shape already loose boulders (Heldal and Storemyr 2007, 86–7; Bloxam 2011b, 47–8). These tools included cobbles of both silicified sandstone and igneous rocks, all locally sourced to the West Bank and roughly shaped into pounders (Heldal 2009, 136–42). Fire-setting is a technology used to

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extract larger blocks from the bedrock and, while it does occur in some grinding stone quarries, its use is far more extensive in all the New Kingdom ornamental quarries (Heldal et al. 2005; Heldal and Storemyr 2007, 102–16; Heldal 2009, 136–42). A further contrast is that prefabricated dolerite tools, with origins on the East Bank at Aswan and commonly found in the granite quarries there, are found almost exclusively in the ornamental quarry localities rather than those used for grinding stones. A further piece of evidence for new injections of specialist stone-crafting knowledge that was hitherto unknown on the Aswan West Bank is an obelisk top with finely carved relief and good parallels in the granite quarries on the East Bank.

So should we interpret these discrepancies and changes as the adaptation of local technologies to quarry new, larger objects, or is it more appropriate to think of the arrival of new stone-workers from elsewhere, bringing both new agendas and different skills? The only textual reference to regional deployment of specialists from elsewhere that might be connected with this period of ornamental quarrying is the stela of 'Bak and Men'. Referring to them as 'overseers of works' and 'chief of the sculptors of the Red Mountain' (the latter thought to refer to the Gebel el-Ahmar silicified sandstone quarries near Cairo) they appear to have been tasked with overseeing the extraction and transport of monuments for Amenhotep III and Akhenaten from Aswan (Habachi 1965). However, any expectation that such imported specialisms would revolutionise existing work practices and technologies proves difficult to substantiate based on the archaeological data. For example, the semi-finishing of objects in the new ornamental quarries did not differ from that used for grinding stone production, with the only notable innovation in the former being the additional step of 'channelling' to extract obelisks (Heldal 2009, 148). Rather, the evidence suggests more straightforward adaptation, on a larger scale, of techniques that had already been known locally for many generations.

Given that obelisk quarrying involved fire-setting and the use of dolerite tools, a feature of granite quarrying on the East Bank (Heldal 2009, 146–8), one scenario to consider is that there was a far more local transfer of specialist stonemasons from the east to west bank, conceivably in the form of a short-term daily commute in which they brought their tools with them. These local transfers might well be considered as only minor forays that did not significantly undermine existing stone-working traditions, particularly since ornamental quarrying in the New Kingdom lasted less than 100 years. Grinding stone production during and after these episodes showed no significant change (Bloxam 2009, 172–4; Heldal 2009, 146).

Figure 5.3 Quarry roads: (a) at Aswan, and (b) at Widan el-Faras (author's photo).

Hence, it is tempting to suggest that what we are observing at Aswan are local stone-working sub-specialisms, rather than large-scale injection of external personnel from central royal workshops. Returning to 'Bak and Men', an alternative reading would be that they were redeployed from the

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central administration in order to enhance transport logistics rather than to assist with physical stone-working. In line with this, it is notable that Aswan boasts perhaps the world's most extensive networks of quarry roads, associated with the transport of mainly ornamental products (Figure 5.3a; Bloxam et al. 2007, 151–62; Heldal 2009, 146–9). We would argue that imported specialist knowledge from elsewhere in the Egyptian state relates strongly to these technologies for road building and logistical organisation and it is in these contexts that we should situate any possibilities for horizontal transmission of technological know-how between local and non-local specialist groups.

Widan el-Faras

The quarry landscape at Widan el-Faras in the northern Faiyum also provides extremely impressive evidence for transport infrastructure, connected with episodic large-scale basalt quarrying during the 3rd millennium BC. Basalt began to be exploited in a substantial way for Old Kingdom temples and causeway pavings. Before this, the material was largely used for stone vessels and tools, but (a) the local evidence for early stone-working at Widan el-Faras itself is far less evident than at Aswan, and (b) many of the basalt stone vessels and tools may have been made from stones coming from other sources (e.g. Mallory-Greenough et al. 1999). In other words, the quarrying of ashlar blocks at Widan el-Faras entailed a more abrupt arrival of new production methods and logistical know-how than at Aswan. Indeed, these changes all happened over a relatively short timespan coinciding with the construction of Khufu's pyramid (see Bloxam and Heldal 2007 for discussion of the 'industrialisation' of the northern Faiyum). One of the results was the world's oldest paved road, constructed from local sandstone, limestone, fossilised wood and basalt and linking the Widan el-Faras basalt quarries to a quay 11 km away on the shore of Lake Moeris, from where the basalt blocks were then shipped out of the Faiyum and over 80 km down the Nile to the pyramid fields at Giza and Abu Sir (Figure 5.3b; Caton-Thompson and Gardner 1934, 136–7; Shafei 1960, 192–3; Arnold and Arnold 1979, 25; Harrell and Bown 1995; Bloxam and Storemyr 2002, 29–30).

These quarry roads also imposed structure on the communities of stone-working practice operating in the area. For example, the densest concentrations of dwellings and inscriptions are found the immediate vicinity of quarry roads. At Widan el-Faras, the only known encampment is situated strategically at the entrance to Widan el-Faras with vantage points north into the quarries and south where the road heads towards Lake Moeris (Bloxam

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and Storemyr 2002, 33–4). Similarly, at Gebel el-Asr in Lower Nubia, the transport route out of the quarries is where we find the only inscription relating to possible 'overseers' of craftsmen and also two distinct Old Kingdom camps (Shaw et al. 2010). Both camps command a clear vantage point along the transport route and reveal pottery assemblages dominated by basic cooking and storage vessels (Bloxam 2011c, 2–3).

The meeting of overland and water transport systems near Widan el-Faras also created important opportunities for interaction between those specialists who transported stone overland and those who operated boats. For example, while ashlar blocks usually left the quarries partially worked, at Widan el-Faras, some further shaping of blocks seems to have occurred at the road terminus at Lake Moeris, in order to further reduce transport weight (Bloxam and Storemyr 2002, 30–1). Further cooperation between different specialist groups is also likely to have occurred here over how best to handle and load large stone blocks. More generally, it is also worth invoking a later series of Middle Kingdom team marks (made by stonemasons) and control notes (made by scribes) on stone blocks for pyramid construction in the Faiyum at Lisht (for what follows, see Arnold 1990, 14–29). Here, a mixture of hieroglyphs and invented geometric characters (some of which also have Old Kingdom antecedents) were either chiselled onto stone or painted using ochre. Almost all of these marks are concerned with transport issues and patterned combinations of verb + locality + workmen in the inscriptions suggests that stone-working teams came from both local communities and elsewhere in Egypt.

The Widan el-Faras road is also a good example of converging kinds of craft knowledge (and people), in spite of the fact that the region does not exhibit the same obviously pre-existing local stone-working tradition as at Aswan. On the one hand, ingenious use is made of local construction materials, most likely borne of certain participants' long familiarity with these resources. On the other, the input of centralised engineering skills is probably discernible in the fact that the road has a width conforming to the standard Egyptian measure of 4 cubits and possessed mortared foundations with parallels at the pyramid construction sites (Arnold 1991, 81–98; Lehner 1997, 203, 215–17). Indeed, the cross-fertilisation of new techniques, from pyramid-building to quarrying, may have been quite common, and is arguably also visible at the Wadi Gerrawi travertine quarries, where limestone masonry techniques first used for pyramids were also employed for building a dam (Petrie and Mackay 1915, 39–40; Murray 1947, 38).

However, despite these instances of technological cross-over from pyramid site to quarry, certain kinds of specialist practice remained exclusive to

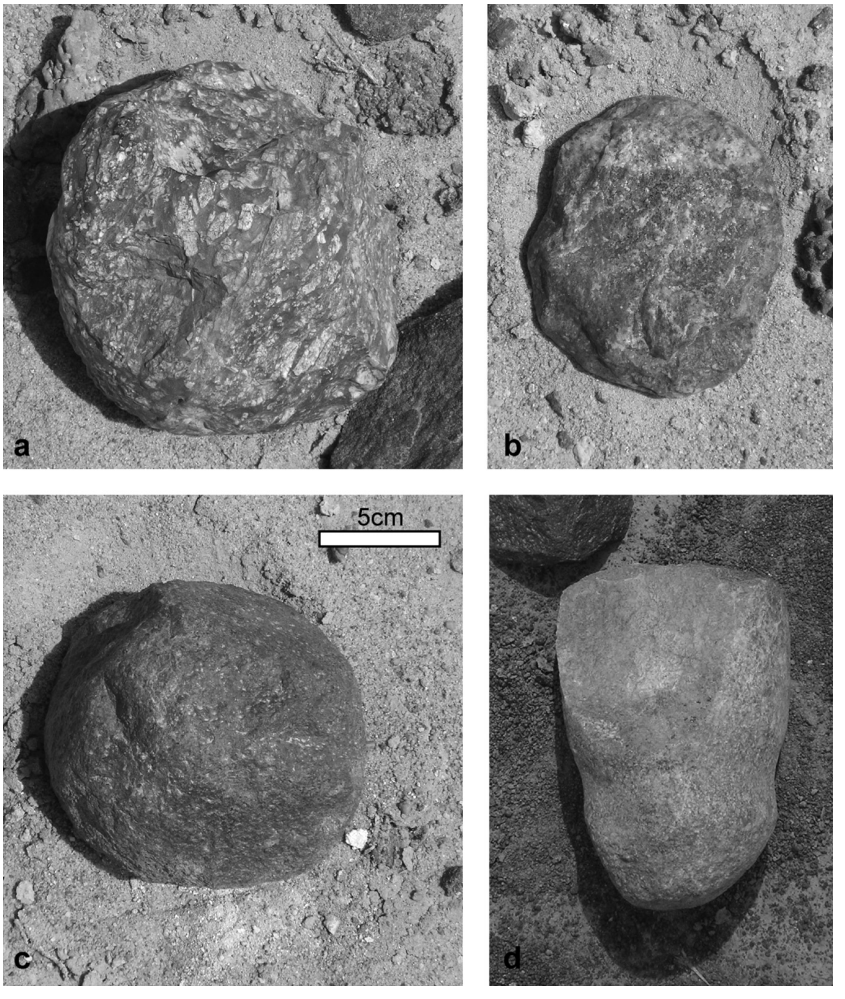

Figure 5.4 Non-local stone tools from northern Faiyum quarries: (a) in diorite (found at Umm es-Sawan), (b) Cephren gneiss (Umm es-Sawan), (c) granodiorite (Umm es-Sawan), and (d) gabbro (Widan el-Faras) (author's photos).

the former locations, and it is tempting to see this as an example of the limits applying to specialist knowledge transfer, at least in the Old Kingdom. For example, once the blocks from Widan el-Faras reached the Giza plateau pyramid complexes and mortuary temples, they seem to have been subject to further cutting-up with large saws (Petrie 1883, 174–5; Moores 1991). The Old Kingdom saw the first application anywhere in the world of large-scale sawing to hard rocks, and it is striking for our understanding of the organisation of stone specialists that this technique is not known at the quarries at this time. While this absence may conceivably just reflect the

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different kinds of task necessary at extraction versus construction sites, it is tempting to instead see it as indicating that certain cutting-edge methods and tools were used only by those specialists who were closely connected to central royal workshops and who worked exclusively at construction sites near the capital.

A final important point to stress is that, although prestige products were primarily channelled to pyramid construction sites and workshops, some exotic stones also found their way into other quarries, usually as tools. In this regard, the northern Faiyum quarries reveal pounders and axes made of an exceptionally diverse range of non-local stones (Figure 5.4a–d): Chephren gneiss from Gebel el-Asr (over 800 km away), diorite from the Aswan region, gabbro and dolerite from other distant locales were all used to quarry basalt at Widan el-Faras (Bloxam and Heldal 2007, 314). At the contemporary Umm es-Sawan gypsum quarries 20 km to the northeast of Widan el-Faras we see an equally high proportion of imported stone tools from the same distant sources (Harrell 2002, 235; Bloxam and Heldal 2007, 314; Heldal et al. 2009, 60). One explanation for this is that the local geology in the region did not provide adequate resources to produce local stone tools and hence there was an unusual need to import these tools to northern Faiyum quarries. Another, which we favour slightly, is that these quarries were also unusually well-connected hubs for stone specialists, with a to and fro of personnel that was itself unusually intense compared to other quarries at this time.

Userkaf and Phyles

It is worth ending this section of Egyptian case studies by focusing on contemporary evidence for working practices at a construction site from a single reign rather than over the kinds of landscape palimpsest often visible at quarries. Out of a range of possibilities, the pyramid complex, sun temple and associated fixed equipment (sarcophagus, statuary, doors, etc.) of the pharaoh Userkaf (c.2460 BC) at Saqqara and Abusir provide a particularly useful vantage. Taken as a whole, these monuments encompass what we might construe as a full range of royal stone resources and major quarries in the Late Old Kingdom: basalt (Widan el-Faras), Chephren gneiss (Gebel el-Asr), pink granite (Aswan), greywacke (Wadi Hammamat), silicified sandstone (Gebel el-Ahmar and/or the Aswan West Bank), travertine (Hatnub and/or Wadi Gerrawi) and fine limestone (Tura). Four limestone tablets found at Userkaf's sun temple also provide one of our best sources of evidence for the structure of stone-working crews linked to a royal construction site (typically referred to by modern commentators via the Greek

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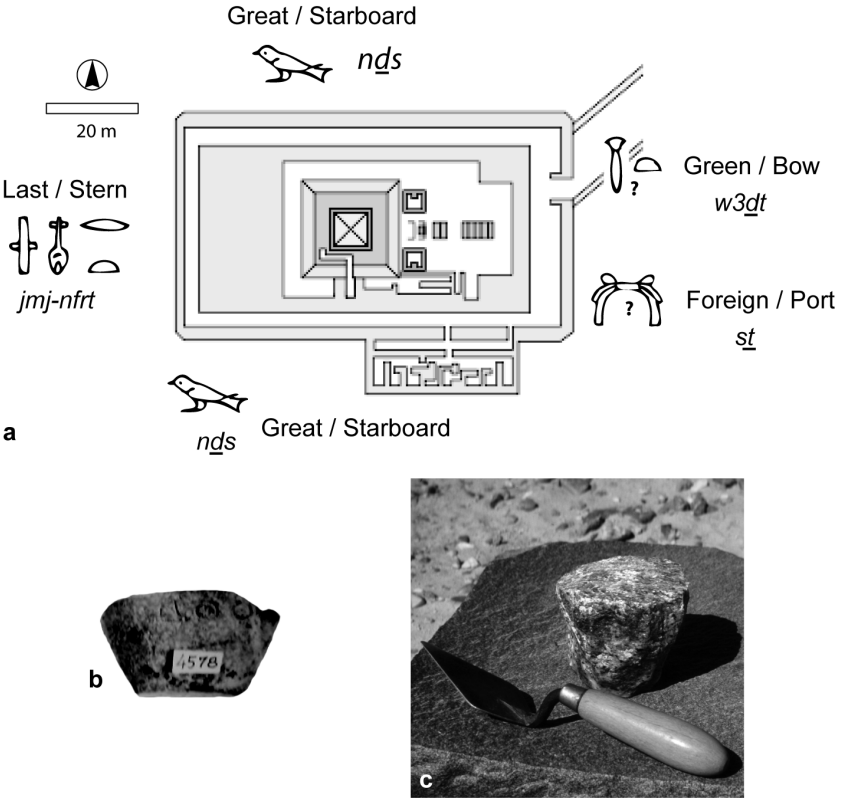

Figure 5.5 (a) Roth's (1991, fig. 7.4 with additions) tentative reconstruction of the spatial organisation of work by phyle groups at the Sun Temple, based on records preserved on four limestone tablets from the site; (b) a small cup, seemingly of Chephren gneiss, found on the Aegean island of Kythera (Coldstream and Huxley 1972, 266, pl. 86), but with an inscription identifying it as from Userkaf's sun temple, and (c) a small vessel pre-form from the Chephren gneiss quarries at Gebel el-Asr (author's photos).

gloss 'phyle': for what follows, see especially Roth 1991, 133–42; also Ricke 1965–9). The tablets confirm other evidence for the existence of five phyles of two divisions each, a structure which has close parallels in the Egyptian royal priesthood. The tablets also suggest that these crews probably served for one month and worked primarily during the two seasons after the inundation. The phyles also seem to have divided up their activities spatially, across different parts of the monument (Figure 5.5a). In this particular instance, at the construction site rather than the quarry, it seems likely that only one fairly large group of stone-workers was employed, such that the opportunities for learning were very likely to be within the group rather than due to the coming together of several different ones.

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Late Bronze Age Aegean Stone-Working

An intriguing but attenuated link between the latter evidence from Userkaf's sun temple and the Aegean 2nd millennium case study that follows is provided by a tiny inscribed stone cup said to have been found in a tomb of probably later 2nd millennium BC date on the Greek island of Kythera (Figure 5.5b; for these tombs see Preston 2007). Such objects are often found in 2nd millennium BC contexts abroad, and while they may very rarely have been local Cretan heirlooms curated from 3rd millennium exchanges, they are frequently likely to have been the proceeds of later 2nd millennium BC tomb-robbing in Egypt (e.g. Phillips 1992). On Crete especially, a case can be made from them being recognised as recycled antiquities but deployed as curated antiques alongside potential powerful claims by certain individuals or groups to lineage and long-term socio-political legitimacy (Bevan 2007, 124–60). In any event, the Kytheran vessel appears to be made of Chephren gneiss (at least viewed through its case in the National Museum in Athens) and its rim bears an inscription identifying it as equipment from Userkaf's sun temple (indeed probably contemporary with the earlier stages of its construction: Sethe 1917). As we have seen, the phyle-based specialists were responsible for the sun temple's construction, and an inscribed chisel (Rowe 1938, 391–3, pl. 57) may also place them at the Chephren gneiss quarries where vessel pre-forms of similar small size and conical shape to the Kytheran vessel have been found (Figure 5.5c). More precisely, the Kytheran example was a model beer bowl and part of a black and white stone pair commonly included in opening-of-the-mouth sets used in both royal jubilee and funerary cult of 5th–6th Dynasty rulers (Bevan 2007, 72, fig. 5.4c). Overall, therefore, the combined example of the gneiss quarries, sun temple and beer bowl miniature evoke a particularly neat example of mobile artisans and mobile stone objects, spanning a thousand years, a thousand kilometres and a range of official and subversive forms of procurement and use.

Minoan Crete

Stone-working in the Aegean also offers a useful complement to the Egyptian case, not least because we can explore two successive and rather different deployments of stoneworkers and stoneworking skills, on Minoan Crete and thereafter on the Mycenaean mainland (Figure 5.6). On Crete we can see experimentation with stone vessels and visible elaborate stone architecture from pre-palatial times, but our focus here is on patterns

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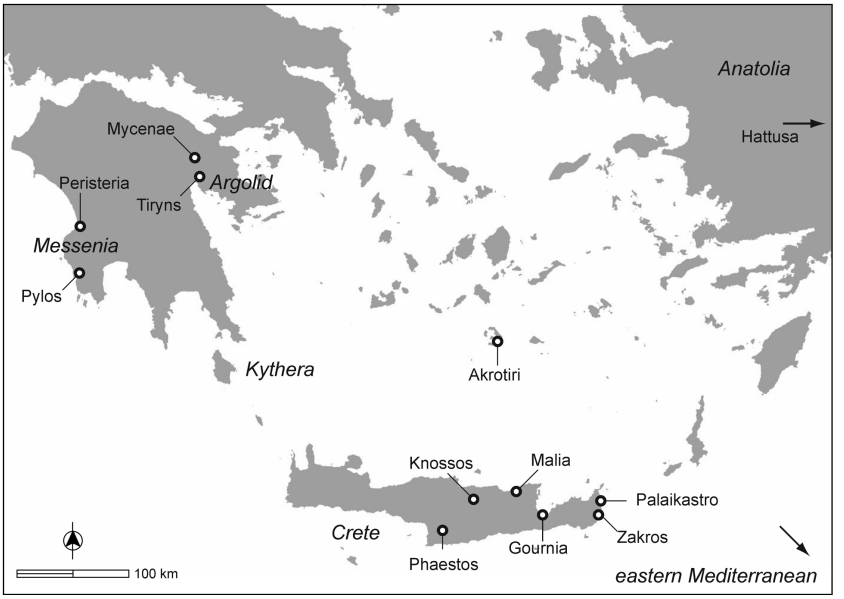

Figure 5.6 Map of the southern Aegean showing the sites mentioned in the text (drawn by author).

visible in the Neopalatial period (c.1700–1450 BC). Both local Cretan and imported stones were being used for portable objects such as stone vessels, tables and lamps at this time (Warren 1969; Bevan 2007, 119–33), while palace-style buildings were regularly constructed in fine ashlar masonry (in limestone, sandstone or gypsum), sometimes faced with gypsum panelling (Chlouveraki 2006).

Ashlar was only used for certain portions of certain buildings and rarely travelled far away from a location point of extraction. A key point to note is that much of the final dressing was often done in the quarry, with multiple ashlar blocks reassembled at the construction site in the same order as they were cut from the quarry. The effort and skill therefore goes in at the point of stone-cutting, while less skilled masons can handle the setting of blocks at the construction site. In contrast, when construction materials are irregular (e.g. the 'Cyclopean' masonry discussed below), the situation is typically reversed: less skilled masons can rough out the blocks at the quarry, but more experienced ones need to handle their selection and combination at the construction site. For example, in eastern Crete, the sandstone used for ashlar in certain important Neopalatial buildings (Malia, Gournia, Palaikastro, Zakros) came from a series of coastal quarries between 1 and 14 km distant from each site, and from which groups of cut blocks could

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probably be transported by raft (Soles 1983; MacGillivray et al. 1984, 144–9). Given the narrow use of such ashlar in this region of Crete, and the relative quantities extracted compared to those consumed, it seems likely that the quarries were opened with a specific construction in mind so skilled masons might spend a one-off block of time at the quarry rather than live near it permanently.

Perhaps the most striking evidence for stone-worker mobility takes the form of mason's marks placed on these fine ashlar architectural blocks (Hood 1987; Chlouveraki 2002; Begg 2004a; 2004b). These usually take the form of small pictograms, with links to, but distinct from, actual Cretan scripts, and the largest concentration of marks is found at Knossos. If we restrict our attention to only the mason's marks of probable Neopalatial date, Knossos' dominance is further emphasised by the fact that smaller sites within, say, four hours' walk of Knossos are far more likely to have gypsum architectural elements, ashlar façades and mason's marks than those further afield. Considering this in its wider context, Neopalatial architecture is largely stone-built, albeit with further use of timber and mudbrick superstructures in many instances (Shaw 2009). Every town and village clearly had access to local or itinerant stonemasons with adequate skills, just as it often did to stone vessel-makers (who may sometimes have been one and the same), as well as potters and other artisans. In contrast, for those elite stone specialists involved in working (and marking) gypsum and ashlar, it is very tempting to see them as a carefully controlled resource, widely used for acts of patronage within the immediate hinterland of Knossos, but only in a very targeted, political way across the rest of the island. The 'gate/window' mark found in an ashlar quarry 5 km south of Palaikastro (Driessen 1984) and whose only close parallels are from 50+ similar signs at Knossos is, we would argue, a good sign of Knossian masons who had travelled to the far east of the island (Figure 5.7).

The meaning of the Neopalatial mason's marks have been the subject of considerable debate, with a range of practical and religious explanations having been offered. Certainly, some of the marks clearly carry Minoan religious connotations (e.g. the double-axe) and some are placed in visually prominent locations on the walls of symbolically charged parts of the palaces. However, we would argue that religious and ideological meanings of mason's marks often follow on from primary practical purposes, in part because wider craft institutions (e.g. guilds, fraternities etc.) with their own symbolic repertoire are often involved. Moreover, many, perhaps the majority, are found in places that would not have been visible on the final monument, suggesting that their role cannot primarily have been for display (Begg 2004a, 220).

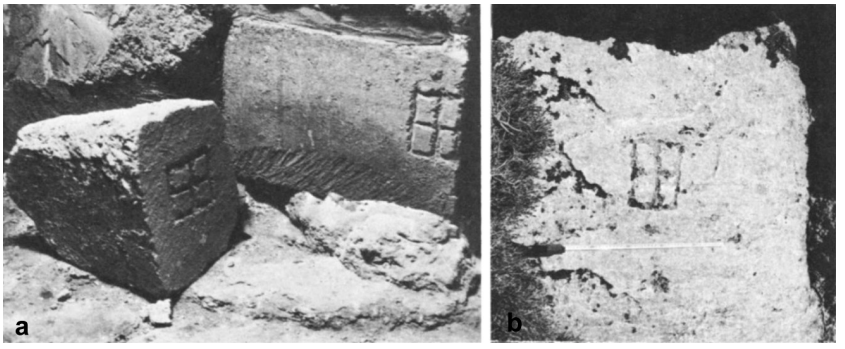

Figure 5.7 (a) 'Gate/window' marks on ashlar blocks from Knossos, and (b) a similar mark at a quarry near Palaikastro (reproduced from Driessen 1984, fig. 13e–f).

We should also distinguish between these mason's marks, and more complex commemorative inscriptions or simpler assembly marks for reassembling cut blocks (de Vries 2009). The latter for example tend to be more numerical in character (quantities of associated blocks, position in terms of vertical courses, etc.), have basic indicators for left/right, and/or lines to guide exact positioning. In contrast, mason's marks often have more complex designs, but ones that also show similarities even in widely separated cultural contexts, as they act as mnemonics for individual workers or groups. More generally, mason's marks are found primarily in western Old World stone masonry practice (to our knowledge) in situations that (a) almost exclusively involve finely finished blocks (ashlar), (b) where the pool of available masons becomes quite large and (c) often when remuneration is accorded by the quantity and quality of piece-work, rather than via regular pay (Nylander 1974; Alexander 2007; Bachmann 2009; Depauw 2009; Fuchs 2009). Of course, we should not push the cross-cultural perspectives too far. There remain some differences between the clear group- or team-marks visible in Egyptian (see Arnold 1990; Andràssy 2009) and Minoan examples on the one hand, and the arguably more individualised marks of certain later periods, suggesting that a model of individual piece-work may not be wholly appropriate for the former. The association of the Minoan marks with small teams of skilled masons seems the most likely, and in some instances the association of certain marks with certain parts of the palace (e.g. the double-axe with the west wings), suggests possible forms of regularised (and potentially hierarchical) tasking for different teams, as also suggested above for Egyptian phyles.

These small teams of Cretan stone specialists were almost certainly attached to one or more Cretan Neopalatial palaces (potentially only Knossos) and

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treated as valuable human commodities, rationed out in acts of patronage from the centre in contrast to the more widespread availability of ordinary masons. In this regard, the parallel situation for fresco painters is instructive. Here too, it seems as if almost every Cretan village could get occasional access to an artisan with sufficient skill to decorate walls or whole rooms, in monochrome or with simple designs (e.g. Blakolmer 2000), suggesting the permanent presence of a local specialist or more likely a lower cadre of itinerant painters and plasterers. In contrast, the distribution of paintings with bulls, griffins, processions and other elaborate designs, made in a wider variety of colours (Bevan 2010b, 40–2, table 3) again maps out a tight hinterland around Knossos and almost certainly reflects a closed group of unusually skilled and resourced artisans deployed via acts of patronage. In the cases of both fancy wall painting and ashlar, there may also be some strong sumptuary laws at work (such that only very specific kinds of people, places and services were perceived as deserving of such patronage), but at a more practical level it almost certainly speaks to centralised control over the tasks taken on by the most skilled artisans.

Beyond Crete the situation seems slightly different: both the wall-painting styles and the mason's marks at Akrotiri, for example, exhibit overlaps with Crete but are nonetheless slightly different, suggesting a related but distinct group of specialists working here and perhaps occasionally on other islands (e.g. Palyvou 2005, 120–1). Beyond this a third distinctive zone of mobility clearly existed, at least for the fresco-painters, as there are extremely good reasons for seeing direct transfers of wall-painting teams from Crete to various eastern Mediterranean centres, with court-to-court gifting appearing by far the most likely form of mobility (see Brysbaert 2008; Bevan 2010b). We will return below to the question of whether this is also to some degree true of stonemasons.

Mycenaean Greece

Whatever the exact character of the transition of political power during the 15th century BC on Crete, there is clearly widespread destruction at Cretan palatial sites. At Knossos, which seems to avoid a full-scale destruction at this time, there is evidence of increasingly strong cultural (and for some commentators, political) influence from mainland Greece, and later on the same observation can be made for much of the rest of the island. Beyond this, 15th- and earlier 14th-century Knossos provides the most likely context for several narrow acts of technological transfer. We might envisage these as occurring alongside a sharp narrowing of the existing metropolitan elite,

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administrative bureaucracy (these two potentially being distinct groups but more likely one and the same) and certain attached artisans. Likewise, over no more than a few generations, these groups were compelled to alter their working practices and interact more strongly with, or travel to, the palace centres on the mainland. For example, Driessen and Schoep (1999) argue persuasively that it is just in this episode at Knossos that Cretan Linear A was most likely adapted to write a narrow range of Mycenaean administrative documents in archaic Greek and disseminated to a wider group of Mycenaean palaces abroad. Likewise, the wide range of manufacturing options exhibited in the stone vessel industry in the Neopalatial period on Crete (especially in terms of drilling methods and shape variety) gives way in the 14th century BC to only one or two manufacturing methods. A much narrower range of shapes almost certainly reflects a much more circumscribed group of specialists, a limited range of operating conditions, as well as, most likely, the transfer of some of these individuals from Knossos to the mainland (Bevan 2007, 157–65, 188–9). While certain craft skills largely disappear from the Aegean in the century or two after the Late Minoan IB Cretan destructions (Rehak 1997), we can also point to a broadening of access to certain stone-working skills that probably reflects a physical diaspora of certain specialists from Crete into an increasingly multi-polar Aegean and an increasingly international eastern Mediterranean.[2]

The sequence of building phases from later 15th to 14th century at Pylos, however poorly preserved beneath the later 13th century (Late Helladic IIIB) palace,[3] appear to be extremely Minoan in character and to change styles in step with those in Crete (Nelson 2001; 2006). The wider region of Messenia also exhibits the earliest tradition of tholos tombs with possible links to the Cretan funerary and architectural practice. Moreover, one block from the Pylos palace received a Cretan-style mason's mark (a double-axe) and two further masons' marks (a branch and a double-axe) have been found on a tholos tomb at Peristeria further north (Nelson 2001, 186 with further references). All of this is wholly out of character with the wider tradition of mainland stone-working at this time (see Darcque 2005) and implies stonemasons who had apprenticed over long periods in a fully

[2] Although we do not address the topic here, there are a range of plausible technical links between the Aegean, Cyprus and the northern Levant during this period, marked e.g. the spread of keel-vaulted tombs, and the 14th-century uptake of ashlar masonry and masons' marks on Cyprus (e.g. Philokyprou 2011).

[3] Note in passing that there is brief mention of a 'wall maker' (*to-ko-do-mo*), who possibly worked in stone, in the Pylos Late Helladic IIIB archives as well as a possible foreman (Ventris and Chadwick 1973, 123, 179–82; Shaw 2009, 166–7).

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Cretan tradition and who continued to adhere to the working practices and affiliations behind the masons' marks. Hence, rather than a vague range of emulative, diffusionist and migratory explanations for these Cretan features (for the spectrum of views, see Hägg 1982; Korres 1984), we would argue that it is worth being more explicit, and suggesting that a limited number of Cretan artisans were being sent to Pylos as part of courtly exchange and/or that they had moved there (voluntarily or under duress) in the aftermath of the Cretan LM IB destructions. We should not necessarily expect that this kind of exchange would leave a much wider cultural signature such as a foreign quarter to the town or widespread Minoanized lifestyles (although there are in fact other forms of evidence at Pylos), just as we see only very limited wider evidence for Minoan presence at Levantine and Egyptian sites who played temporary host to Cretan fresco-painters.

Another site that shows evidence of Cretan technological influence is Mycenae. Several blocks with Cretan masons' marks suggests, as at Pylos, that Cretan artisans may have contributed to early architectural phases about which we unfortunately know very little. The Atreus tholos makes use of three stone resources that would be very familiar to Cretan artisans: gypsum, probably from central Crete, *antico rosso* marble from the Mani and *lapis lacedaemonius* from near Sparta (Ellis et al. 1968; Younger 1987; Gale et al. 1988; Cavanagh and Mee 1999). The combination of hammer-dressing, sawing, tubular drilling and chiselling on frieze fragments and façade also fitted well within an established, previously strongly Cretan technical tradition (Wright 2006, fig. 1.4). A further good example is also provided by the stone vessel assemblage at the Mycenae Ivory Houses, which exhibits a narrow set of technical characteristics, such as multiple assembly and diagonal tubular drilling, that have no technical antecedents on the mainland and instead represent the narrow survival of one particular approach out of many in which Cretan artisans might go about making stone vessels (Bevan 2007, 163–5).

In the late 14th–13th centuries BC (Late Helladic IIIA2–B), there is a shift away from this investment in elaborate funerary monuments towards the construction of fortifications, bridges and dams (Hope Simpson and Hagel 2006). The motivations for this massive switch in investment are not something we address here, but it is worth stressing that it is likely to have required shifts in the scale of the labour force towards greater emphasis on larger work gangs overseen by only few specialists (Fitzimmons 2011). The new emphasis on roughly finished 'Cyclopean' walls is in step with this shift in labour profile. One hotly debated set of possible technological links is those suggested between Hittite Anatolia and the Mycenaean

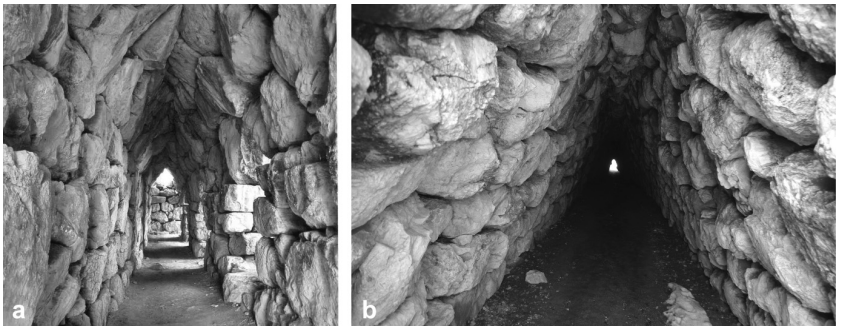

Figure 5.8 Corbel vaults: (a) at Tiryns and (b) Hattusa.

world. On its own, the adoption of Cyclopean masonry or the common choice of conglomerate for monumental portions of gateways is not a very good justification for these Mycenaean-Hittite links (Loader 1995; Maner 2012), especially in light of the very limited amount of portable material culture that we have identified so far as flowing between these two regions (Cline 1991). Even so, if we confine ourselves to a narrow range of technical procedures such as the hypothesised use of 'pendulum' saws, certain presence of drill-hole attachments and impressive parallels in corbel-vaulting techniques then the arguments are on firmer ground (Figure 5.8; Maran 2004; Maner 2012; also Seeher 2005; 2007). Moreover, this narrow range of shared techniques is matched by a narrow geographical spread, with most of the evidence coming from Tiryns and Mycenae in the Argolid on the one hand, and the central Anatolian capital at Hattusa on the other, suggesting that, again, direct court-to-court transfer of one or more specialists (who would then have to work with a local labour force) might be a better model (as argued by Maran 2004a) than a more general one of itinerant masons or a much vaguer one of broad cultural diffusion.

Conclusions

The discussion above has clearly only touched the surface of the range of stone-working evidence available to us from the Bronze Age eastern Mediterranean, but it nonetheless affords a clear view of specialists in motion, both within and between states, as well as episodes of technological transmission. We have emphasised the range of different ways in which individuals and groups acquire stone-working skills, share them with one another and/or retain these skills over multiple human generations. All of

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this should serve as a strong reminder of what we stand to lose if we merely suggest that craft skills spread or diffuse in a formless way through time and space. Rather, we need to be more explicit about the social contexts and mechanisms by which people and ideas move around the Bronze Age eastern Mediterranean, even in cases where our interpretative agendas are very generalising and/or comparative ones.

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