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Grave Reminders : Comparing Mycenaean tomb building with labour and memory

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Chapter 2. Setting

I could not but look upon these Registers of Existence, whether of Brass or Marble, as a kind of Satire upon the departed Persons, who had left no other Memorial of them, but that they were born, and that they died.
Joseph Addison (1711)

Bleak as it is to confront oblivion, no shortage of artists have tried. Bindman (1999: 93) introduced his work on commemorative futility with its captivation of eighteenth-century English writers like Addison, who remarked on the inevitable oblivion that awaited both elaborate and common grave memorials. Tombs fall into disrepair and names come to mean nothing. That cold reasoning tends to fail, however, in discouraging the pursuit of fame with tomb investment. Tomb expense and design encode—rather than determine or confine—where remains and mourners parted ways. With this chapter I elaborate on Mycenaean multi-use tomb investment, from general architectural forms and funerary development (Section 2.1), to physiographic (Section 2.2) and social (Section 2.3) constraints. The goal here is to simulate the starting components of Mycenaean tomb construction, including the ground underfoot and ideas as to how and why to shape it.

2.1. Mycenaean tomb development

As far removed as we are from the Mycenaean funerary experience, some limited windows remain to that perspective. Each of the tombs, no matter how undersized, played a momentous role for multiple witnesses, before being broken open much later under different eyes for loot or knowledge. The experience was visceral for events near tombs during their primary phase of use. Hands raised near the head, torn garments, mouths open in lament, and possible facial scratches tag mourners on the painted Tanagran *larnakes*, and the more animated of these figures might be closely related to the deceased (Cavanagh and Mee 1995: 47). Female ceramic figurines recovered in LH IIIC tombs at Perati, Kamini, and Ialysos similarly show the tearing of hair and garments (Cavanagh and Mee 1995: 51), while mourners depicted on rings from Vapheio and Mycenae lie prostrate on shields in apparent grief for lost warriors (Evans 1901: 179–180). Re-inhabiting those feelings of fatigue and despair lies beyond the reach of the modern observer, though others have shown interest in reviving a multi-sensory experience of tombs (e.g., Barrie 2010: 228; Boyd 2014a: 200, 2016: 63; Watson and Keating 1999: 327–329).

For three years and more, Mycenaean tombs became part of my world. For others, lifetimes have been spent there and, since the mid-nineteenth century, roughly to the same end of piecing together lives from limited evidence of the dead. The assembled knowledge is immense. In his review for a wider audience, Cavanagh (2008: 327) correctly described Aegean archaeology as being "haunted by graves", with the number of excavated tombs climbing into the tens of thousands. Settlements, even palatial ones, were too few and muddled in the archaeological record to afford being selective with supporting mortuary evidence. That affordance has tightened in recent years with substantial surveys across southern Greece (e.g., Cavanagh et al. (eds) 2002; Davis et al. 1997; Wells and Runnels (eds) 1996). Forecasting of LH III palatial complexes using MH/LH elite burials no longer avoids critique (Boyd 2015a: 201). The time gap is daunting, and the consumption practices of early elites were indeed executed with their own parameters in mind. Voutsaki (1995: 62, 1997: 37–44, 2001: 205–207, 2010: 82) highlighted their flagrant practices with portable wealth, which continued even as architectural developments spent centuries making the jump from monumental tombs to monumental public spaces. The apparent tardiness of Cyclopean—rubble-style assembly of massive unworked stone—fortifications and other palatial building programmes, particularly on a crowded acropolis, may have more to do with obscuring or destroying predecessors, of which we know very little (Boyd 2015a: 201).

Mortuary architecture, on the other hand, is easier to read and has given rise to detailed sequences across southern Greece (e.g., Boyd 2002, 2014b, 2015b; Dickinson 1983, 2016; Fitzsimons 2006; Lewartowski 2000;

Mee and Cavanagh 1990; Moutafi and Voutsaki 2016; Papadopoulou-Chrysikopoulou et al. (eds) 2016). One hallmark of early Mycenaean behaviour was a rapid transition from austere simple graves in MH tumuli to richly provisioned shaft graves and LH built and cut multi-use tombs, though cists and simple graves of variable wealth persisted throughout (Lewartowski 1995: 106–107; Voutsaki 1997: 44–45; Voutsaki et al. 2018: 170). Boyd (2015a: 201) mapped the changes in five core areas, paraphrased here as (1) tripartite architecture (chamber tombs and *tholoi*), (2) collective (or multi-use) practices, (3) secondary treatment of remains, (4) dedicated funerary spaces (extramural cemeteries), and (5) objects created and manipulated for mortuary ritual. My focus falls on the developed (LH IIIA) and end-stage (LH IIIC) variants for the first two categories (collective or multi-use funerary architecture), with some comments on the spatial layout of two large Mycenaean cemeteries in western Achaea.

Funerary architecture in southern Greece at the MH/LH transition suggested influence from similar Cretan forms via Kythera (Dickinson 1977: 61; Hood 1960: 168), evolution from MH tumuli spread across the mainland (Boyd 2002: 55–56, 218; 2015a: 202; Cavanagh and Mee 1998: 44–45; Voutsaki 1998: 43), or combined innovation with some elements of Kytheran, Cretan, and earlier mainland traditions (Gallou 2009: 89). LH I–II tumuli in western Greece appeared at Chalandrtisa-Agriapidies in Achaea as well as several locations from Elis-Olympia, Messenia, Kephallenia, and northward along the coast to Albania (Aktypi 2017; Papadopoulos 1995: 203–205). To that list can be added the tumuli from Portes. Papadopoulos (1995: 205) saw the practice as a continuation of earlier ("pre-Mycenaean" or late MH) traditions. More recently, elements of *pithoi* (very large ceramic jar) burials in MH tumuli have been compared with *tholoi* in the sequence at Kaminia in Messenia (Boyd 2015a: 202–203; Korres 2011: 589; Papadimitriou 2011: 473–474). With borrowed ideas of form and practice from earlier tumuli and *pithoi*, *tholoi* resemble earlier tumuli from most outside perspectives when covered with an earthen mound or sunk into a hillside (Galanakis 2011: 220). The key difference is the shift in focus to activity within the chamber (Boyd 2015a: 203; Gallou 2009: 89). Whatever the case for their origins, *tholoi* appeared in Messenia during MH III, proliferated during LH I, and spread across southern Greece in LH II (Boyd 2015a: 202). Chamber tombs appeared slightly later (LH I in the Argolid, Laconia, and Messenia) before co-occurring and becoming the dominant form outside Messenia after LH II (Boyd 2015a: 202; Gallou 2009: 87). Most large chamber tombs were built during early Mycenaean times (LH IIB–IIIA1) and followed closely the height of large *tholos* construction (LH I–IIA) in the same regions but rarely the same cemeteries (Galanakis 2016b: 162). Labelled by Pelon (1976: 340, 417–418) as Type III, *tholos* tombs in western Greece tended to be smaller and less well-constructed, omitting in many cases a clear transition between the *dromos* and *stomion* and occasionally having slabs over part of their entrance passages (Papadopoulos 1995: 203).

Chamber tombs in western Greece especially bore a strong resemblance to one another in construction and custom, including the widespread practice of multiple burials in pits, to which tombs on the Ionian island of Kephallenia seemed to adhere most (Papadopoulos 1979: 60–61, 1995: 203). General chronological trends for LBA Achaea highlighted chamber tomb construction during the LH IIIA period for coastal sites (Chadzi-Trapeza, Vrachneika), LH IIIB period for the Pharai sites (Chalandritsa, Katarraktis, Leontion) as well as Dherveni, and LH IIIC period for the Kalavryta and Tritaea sites (Drosia, Kertezi, Manesi) in the mountainous interior (Papadopoulos 1979: 57; Table 1.1, this volume). Forming a clearer picture from more recent excavations, chamber tombs at Achaea Clauss, Portes, and Voudeni cut across the LH III period in construction and reuse (Kolonas 2009a, 2009b; Moschos 2000; Paschalidis and McGeorge 2009; Chapters 4 and 5, this volume). The later appearance of construction in LH IIIC Kephallenia suggested to Papadopoulos (1979: 60–61) a migratory influence—one of many possibilities for the rippling westward trends mentioned earlier—but how those tomb forms initially arrived in Achaea must have followed upon their popularity elsewhere in southern Greece.

Increasing steadily during the LH II period, LH III construction of chamber tombs experienced a meteoric rise across southern Greece (Boyd 2015a: 205). Chamber tombs are by far the most common recorded funerary architecture for LH Achaea, with already 219 examples across 58 sites known by the 1970s (Papadopoulos

1979: 51, 60; see Table 1.1, this volume). From 1919 to 1940, Kyparisses investigated at least 150 of them, for which few and brief records survived (Papadopoulos 1979: 51). The large number of known examples repeated shapes and styles by preference, rarely diverging radically. Since *dromos* shape was largely beholden to scale (Chapter 4), chamber shape offered more freedom of choice, particularly in roof shape. Galanakis (2016b: 159) listed five common roof types, paraphrased here as (1) irregular, (2) horizontal or slightly arched, (3) saddled, (4) tholoid, and (5) pitched. Where preserved, the tholoid type often contained a *hypotholion* at its apex, which apart from mimicking a *tholos* roof could allude to "a 'hut's smoke hole' or a 'slot for a roof post'" (Galanakis 2016b: 159; Kolonas 2009b: 16; Chapter 4, this volume). Several other elaborations (e.g., grooved sidewall, also referenced as ledges, shoulders or eaves, and "ridge poles (imitations of central beams)") point to correlations between mortuary and domestic architecture (Galanakis 2016b: 162).

Galanakis (2016b: 159) focused on pitched roofs in chamber tombs, the earliest of which appeared during the LH IIA–IIIA2, mostly in the northern Peloponnese. Although not universal (cf. smaller counterparts at Kallithea-Spenzes in Achaea), chamber tombs with pitched roofs are larger on average than tombs otherwise roofed and include some exceptionally large examples, as at Antheia Ellinika in Messenia (Galanakis 2016b: 160–161) and Voudeni's largest excavated tombs (VT4 and VT75) (Kolonas 2009b: 15–17, 27–29; Chapter 4, this volume). LH II–IIIA2 chamber tombs with pitched roofs co-occurring alongside those with tholoid roofs, as at Mycenae and Voudeni, reinforces the idea of divergent traditions in early Mycenaean tomb building, where Galanakis (2016b: 162) has suggested competition with societal overtones. This mirrors the case put forward by Voutsaki (1995: 62; 1997: 44–45) for competition with portable wealth in grave offerings, though—perhaps through targeted reuse or looting—chamber size at Voudeni did not always correlate with the most used or best equipped (Moutafi 2015).

Exponential differences in Mycenaean tomb scale and relative locations (e.g., clustering of tombs within cemeteries) have informed positions on mortuary changes as much or more than the aforementioned variations in style. Boyd (2015a: 215–216; 2015b; 2016) framed tomb scale as elite manipulation of space and perspective using the 'mega-*tholoi*' of Mycenae. From situating the individual body in a standard space to allowing for "dozens in the chamber, hundreds in the *dromos* and on the slopes above", growth in mega-*tholoi* highlighted a larger audience (Boyd 2015a: 216). Even so, most of the action takes place on the way to the tomb, where positioning matters. Early *tholoi* were cut underground to support their superstructures, but many were sited within or around earlier tumuli. Techniques expanded to purpose-built tumuli as counterweights to *tholoi* vaults above ground (Boyd 2015a: 202–203; Cavanagh and Laxton 1981: 111–118; Hitchcock 2010: 205; Papadimitriou 2015: 100). Chamber tombs and multi-*tholoi* mound groupings opted for clustering rather than visibility (Kontorli-Papadopoulou 1995: 122), unlike the larger *tholoi* set apart in later examples (Boyd 2015a: 204). Early (MH III–LH I) elaborations on simple graves, including large cist and built chamber tomb types, as well as Mycenae's shaft graves, show another form of clustering and, occasionally, experimental *dromoi* (Boyd 2015a: 204–205; Papadimitriou 2001a: 93–94; 2001b: 43; 2015: 82, 101). The longer *dromoi* of later, larger *tholoi* facilitated mortuary innovation focusing on spectacle (Boyd 2015a: 205; Papadimitriou 2011: 477; 2015: 71–72, 101). Spectacle—for similarly large audiences at least—operates for the Achaean chamber tombs only under the condition of performance away from its cramped spaces.

Contextualised and interdisciplinary approaches have proliferated in recent years as our understanding of Aegean mortuary architecture pivots toward performative space (Boyd 2014a; Dakouri-Hild and Boyd (eds) 2016: 2; see Maran 2006a, 2006b for the same trend in citadel layout). Secondary practices, like fire use and the deliberate disarticulation and commingling of remains, have especially seen recent reassessments (e.g., Galanakis 2016a; Jones 2014; Moutafi 2015). Fire use in tomb chambers, for instance, has been interpreted variously since the late nineteenth century as evidence for cremation, lighting, purification (ritualised), and fumigation (a practical step to alleviate the stench) (Galanakis 2016a: 190 with references; Kontorli-Papadopoulou 1995: 118). Difficult to identify properly and often missed or misread in earlier research, confirmed fire use is neither universal nor perhaps as rare as low percentages suggest (Galanakis 2016a: 190). Multiple applications in

different locations make it unlikely that there was any one rule governing fire use in post-funerary practices (Galanakis 2016a: 193–194), much as there seems to have been a certain freedom of choice in burial (Kontorli-Papadopoulou 1995: 114). Likewise, no one rule applied to tomb shape and scale, but a combination of mimetic design for shape and risk assessment for scale seems as likely as fire's multiple uses for lighting and fumigating dark chambers.

2.2. The rock canvas

With the above section having established general trends in Mycenaean tomb development, this section elaborates on physiographic constraints to tomb design, outlining the composition and physical properties of soils in Achaea and Attica. I comment mostly on geological and hydrological processes in southern Greece and how these affected human activity during the Bronze Age. Since concerns over water management weighed heavily on Mediterranean populations then as now, water is helpful as a signpost for general climatic trends and the first to constrain labour given the lethal consequences of its absence. Infiltration from intermittent rainfall also heavily affects tomb preservation, and the response of rocky soils to weathering and tool strikes partly explains the surviving tomb shapes. The following subsection reviews the dynamic rock canvas from which Mycenaean tombs were built and how they have resisted entropy.

2.2.1. Physiography of southern Greece

Stark contrast with temperate climates familiar to Western researchers, particularly during the summer fieldwork season, has earned Greece dire environmental descriptions, "a land of dry and barren mountains, poor in fertile, well-watered soil" (van Andel et al. 1986: 103). A fairer representation characterises Greece as a typical landscape of thermomediterranean valleys broken by meso- and supramediterranean mountain zones (Yassoglou et al. 2017: 11). Hot summers exacerbate dry and rocky soils that otherwise appear fertile in the rainy spring and late autumn. Tempering those hot summers at higher elevations, these bioclimatic regions foster sclerophyllous vegetation of dense evergreen scrub (Velitzelos et al. 2014: 56), with dominant species including smilax (*Smilax aspera*) and juniper (*Juniperus communis*). For the Mediterranean region in general, forests tend to occupy cooler highland areas beyond the premium space claimed for agriculture in the lowland plains (Meiggs 1982: 40). Thriving in the middle zone (500–1,200 m above mean sea level (amsl)) as described by Meiggs (1982: 42), deciduous trees such as oak, chestnut, maple, and hornbeam—evidently preferred for oxen yokes (Plommer 1973: 4)—lend themselves to coppicing, an economical way of sourcing firewood and high-demand building timbers by exploiting the ability of these trees to grow back from root systems after cutting. For much of antiquity, oak was likely the most widely distributed of trees below 800 m amsl in southern, western, and central Greece (Meiggs 1982: 109). The valley climate here continues to support a thriving vine, olive, and citrus agriculture (Kavvadias et al. 2013). The success of that industry has been dependent on water management, made precarious by infrequent, heavy rains that drain rapidly through rill flow and interrill infiltration.

Soils with abundant rock fragments represent more than 60% of Mediterranean soils, prompting much research on the properties of rocky soils and their hydrological responses (Poesen and Lavee 1994). Rock fragments ranging from pebbles to large cobbles are prevalent throughout the study area and have shaped how populations have managed it. Depending on rainfall amounts, rock fragment size and quantity can affect water conservation by either increasing (non-drought or large surface cobbles) or decreasing (drought) water retention beyond the capacity of soils with fewer stones (Danalatos et al. 1995). Runoff and sediment loss also increase where surface rock fragments and less vegetation fail to consolidate soils under rainfall of varying intensity (Moustakas et al. 1995: 115), though laboratory tests have shown more ambivalence linked to soil particle size, subsurface rocks, preceding moisture content, and the "umbrella effect" of surface rocks (Jomaa et al. 2012: 11; Smets et al. 2011). Removal of surface rock fragments, as might be the case in agricultural field and tomb site preparation, drastically increases erosion rates (Cerdà 2001: 59; McNeill 1992: 311). Overall, rocky

soils have been beneficial to agricultural productivity in the Mediterranean by decreasing water loss through evaporation and limiting deflation by wind erosion, with runoff effects varying according to surface coverage (Cerdà 2001: 66). For soil use in construction, however, rock fragments have mostly negative impacts, greatly increasing labour and decreasing tool use-life (Milner et al. 2010: 103; Xie 2014: 297). Construction of new tombs in a growing cemetery would require at least partial clearance of vegetation and surface stones to avoid complications with work flow. Loose rocks sliding into an open *dromos* of more than a few metres depth could prove fatal for tomb builders or mourners, adding a practical element to keeping the immediate vicinity clear of debris.

The soils and parent rock materials of Achaea and Attica share several properties with those found in much of Greece and around the Mediterranean. Low organic content and abundant rock fragments typify the well-drained, calcareous slopes eroding from shallow flysch, conglomerate, and limestone bedrock (Yassoglou et al. 2017: 10–13). The most common parent material associated with Mycenaean rock-cut tombs, *kimilia*, can be described as foraminiferous (fossil-rich chalk) or argillaceous (containing clay, as in the lime-clay mixed marlstone)—both derive from calcium carbonates with ultra-small particle size ideal for chamber tombs, as noted at Mitopoli (Kolonas 2009a: 20). Others have focused on formation or age to label the rock, such as "Neogene marls" (Cavanagh and Mee 1999: 96), lacustrine or lake-deposited (Andreou et al. 1996: 540–542), karstic or cave-forming (Vika 2009: 2024), or simply "soft, impure limestones" (Mason 2007: 39). With the exact diagenesis of flysch, conglomerate, and limestone—each thrust upward from an ancient sea bed of variable depth (see below)—being unknown to tomb builders, it is generally enough to note that they preferred these sedimentary formations for holding shapes while being relatively easy to cut.

Soil profiles throughout the southern Greek mainland have been defined largely from movement, whether tectonic, aeolian, nivation, or alluviation. Sediment cores from the Messenian plain in the south-western Peloponnese show Plio-Pleistocene sediments at higher elevations and Holocene floodplain deposits with an average thickness of 90 metres (Katrantsiotis et al. 2016: 189). During the Early Bronze Age, land clearance began to have a significant effect on soil composition in densely populated areas of southern Greece, notably in the Argolid (van Andel et al. 1986) and Messenia (Katrantsiotis et al. 2016: 189–190). Locally, soil modifications in Achaea and Attica followed a similar pattern, with activity intensifying prior to the LBA if known tombs and settlements provide an accurate sample (Papadopoulos 1979; Table 1.1, this volume).

In addition to the relative antiquity of human environmental modifications in the region, comparatively recent natural processes in geological time (roughly the past 250 million years) have shaped topography and climate in the Aegean. Young mountains of "blinding limestone" once occupying the shallow bed of the Tethys Sea now girdle its Mediterranean successor, products of plate collisions that also power the region's active volcanoes (Shiel 2016: 67–70). Throughout the late Pleistocene and early Holocene, colluvial deposits accumulated in valleys from erosion driven primarily by runoff on steep slopes (Pope and van Andel 1984: 282; van Andel et al. 1990: 381). This sloping terrain ensures sufficient and occasionally excessive drainage affecting tomb preservation. Loss of mountainous glaciers and snowmelt after the most recent Ice Age around 20,000 years ago triggered rapid alluviation in Greek valleys (Woodward and Hughes 2011; Yassoglou et al. 1997: 264), and colluvium from the slopes increased again from Early Bronze Age land use (van Andel et al. 1986: 105). Colluvium (accumulation from hillslope erosion) and debris dominate soil profile descriptions, particularly where tombs trap the downward slide of destabilised materials (e.g., Rife and Morison 2017: 39). As discussed later in this chapter in relation to the somatic risks challenging LBA Aegean tomb builders, the loss of mature forests and depletion of soil minerals may also have contributed to the rise in infectious diseases like dysentery, hookworm, and malaria as early as the Neolithic (Angel 1972: 90; Arnott 1996: 265–266; for a similar situation in Roman Italy, see Sallares 2002). Although less of a problem in southern Greece where rivers often vanish into dry limestone beds (Shiel 2016: 70), slow rivers in southern Mesopotamia incubated malaria and schistosomiasis (McMahon 2015: 32).

Reactions to environmental change, whether accompanied by health risks or not, remain visible. For instance, erosion and flooding initiated significant countermeasures in the LBA Argolid, where the construction of the Tiryns dam rerouted a stream threatening the Lower Town with seasonal flooding (Balcer 1974; Bintliff 2019; Maran 2010: 728; Maran et al. 2019; Weiberg et al. 2016: 47; Zangger 1994). Roughly a century later, engineers in the Late Helladic IIIC period diverted the Alfeios River near ancient Olympia (Giannakos 2015: 73–75). Earthen dams initiate controlled seepage along the *phreatic* (saturation) line, not so much halting the flow of water as drastically reducing it (Bowles 1984: 277, 286). Unless it held back a reservoir following an especially wet winter, the Tiryns dam would have acted more as a diversion barrier, needing no impermeable core to address flow net theory (Bowles 1984: 286).

Apart from flood mitigation, generations of agricultural specialists on the southern Greek mainland sought to conserve water through tactical soil movements, mostly terracing (also deployed for construction, e.g., Nelson 2007: 150–151) and irrigation. Although effective in combating semiarid conditions, complications can arise that reverse the advantage of irrigation. Known as bypass flow, loss of water and soil nutrients through cracks in dry soil threatened land productivity from the outset of intensive agriculture in the region. This presents an even greater problem for modern irrigation, which exacerbates the same effect during the dry season (Kosmas et al. 1991: 140). Unlike the Tiryns dam in the Argolid and land reclamation from Lake Kopias in Boeotia (Giannakos 2015: 73), large irrigation efforts in the LBA have not been found in the immediate vicinities of Voudeni, Portes, and Menidi, but standard infrastructure projects like bridges and roads abounded (Hitchcock 2010: 206; Hope Simpson and Hagel 2006). Placement of the settlement and burial areas for these sites on high ground, with ready access to natural channels like the Meilichos (Voudeni) and Pinios (Portes) rivers, removed the need for significant artificial drainage works but raised the stakes for reliable sources of potable water. Springs provide the only steady source of water in most areas of Achaea, whose rivers tend to dry up without snowmelt and a reliable rainy season (Papadopoulos 1979: 21).

2.2.2. Soil mechanics and risks

The case study sites that feature prominently in later chapters show no exceptions to the soil map of the wider regions (Figures 2.1–2.2). Light-coloured, friable luvisols appear at both cemeteries in Achaea, with a sandier tan from flysch at Portes and more homogeneous grey from Mesozoic limestones at Voudeni (Yassoglou et al. 2017: 12, 33). The soils around the Menidi *tholos* have been heavily modified by the urban expansion of modern Athens, but the mound above the tomb retains enough undisturbed material to reconstruct pre-modern conditions. Of natural processes that have affected tomb preservation at the sites, tectonic activity and water infiltration are the most visible. These are discussed alongside other risk factors for earthen architecture below. Damage to individual tombs perceived during fieldwork or indicated by site guards will be specified in Chapter 4.

As seen above, soil studies conducted in Greece and similar environments have focused on the primary concern of land management within the region (both recently and in prehistory): agriculture and water conservation in a climate susceptible to rainfall variability and drought. Recurring summer droughts followed by "strong katabatic winds and periods of intense, in autumn often thundery, rainfall" combine to speed soil loss, with up to 20 cm per thousand years dumped from steep coasts onto the sea floor (Shiel 2016: 70). Many of the properties affecting farming and water conservation efforts also apply to soil movement in tomb construction and preservation. Without adequate drainage and maintenance of soil compaction, shear stresses could result in lateral flow and collapse of voids opened by construction; failure is caused by soil particles sliding or rolling over one another (Bowles 1984: 310–312; Selby 1993: 27–34), rather than the tearing of tensile materials (wood, fibre) or the shattering of crystalline structures (rock, glass) (Cotterell and Kamminga 1990: 68–71). Subsidence and catastrophic ground loss also threaten underground excavations that disrupt the balance of nearby loads in weakly bonded soils (Bowles 1984: 356–359; Selby 1993: 111–121). Differential settlement affects most tombs, since imperfections in the friable paralithic bedrock leaves stability an open-ended ques-

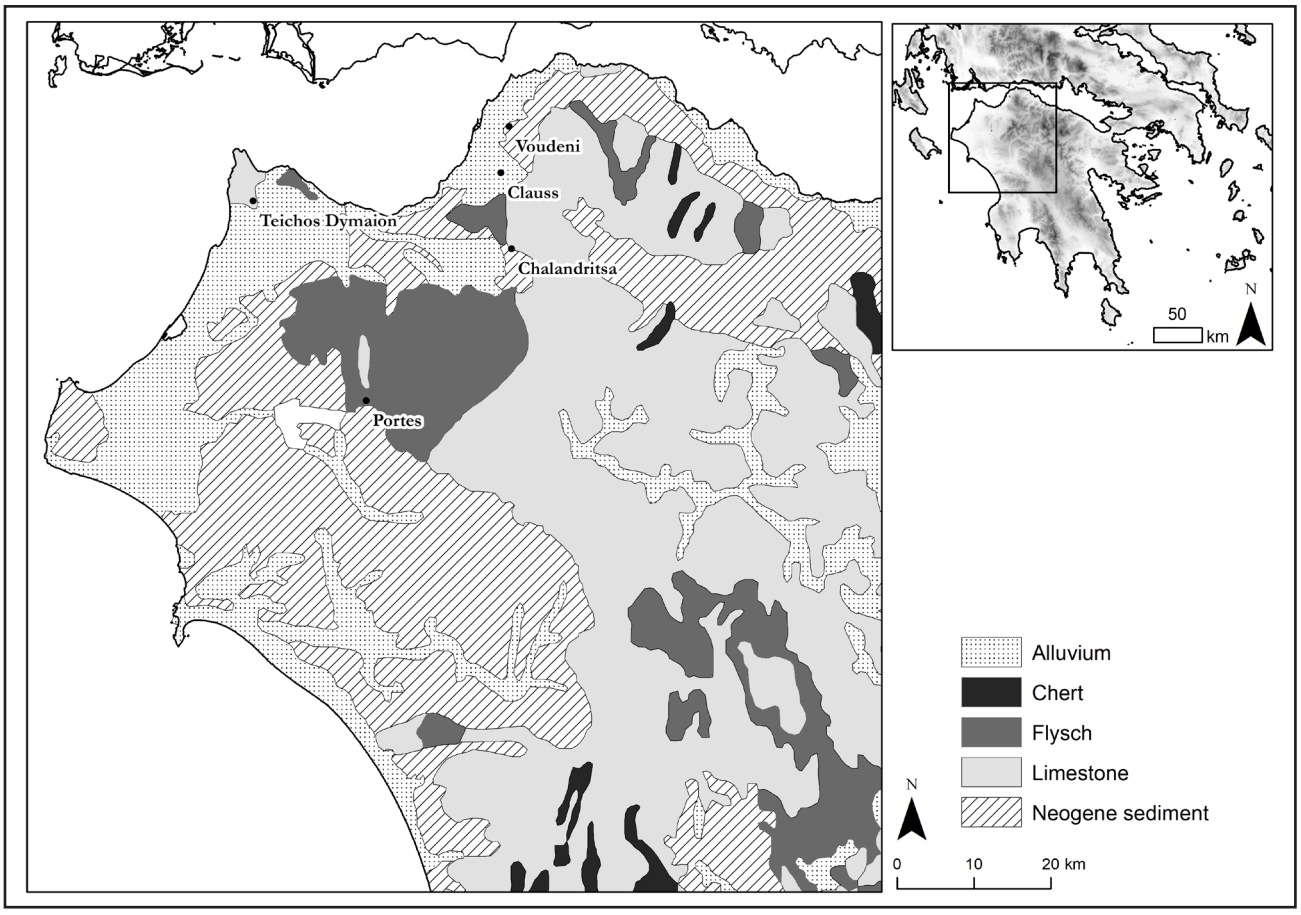

Figure 2.1. Geological map of the north-western Peloponnese, based on Higgins and Higgins (1996: 66).

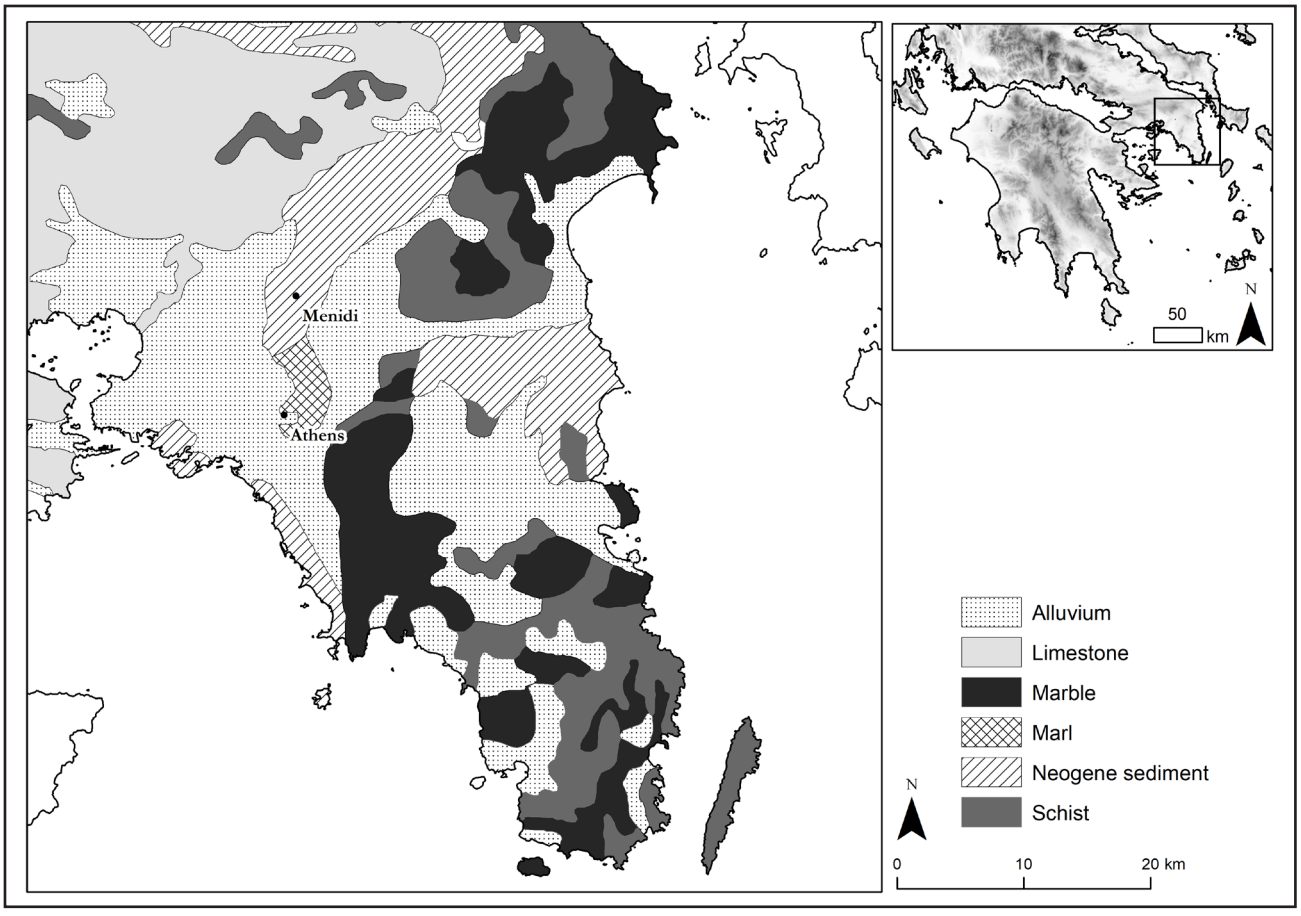

Figure 2.2. Geological map of Attica, based on Higgins and Higgins (1996: 27).

tion, causing cracks where the imbalance of loads has shifted the built feature and the surrounding soil matrix. From field observations, the most destructive natural forces acting upon the tombs have been infiltration by rainfall, nivation in colder winters, and tectonic activity.

Human threats to tomb preservation have taken a greater toll than natural processes. Cultural priorities shifted away from the monuments at the end of the Bronze Age, leading to neglect or reappropriation of the features and surrounding land for other uses, such as the early modern conversion of chamber tombs near Drosia into quarries and lime pits (Papadopoulos 1979: 33) or those used at Lysaria-Pori as sheepfolds (Aktypi 2017: 1). The mythos of larger and better-built burial mounds persisted (Alcock 2016), with their social advantages still plain to tomb cults and the Homeric epics recorded centuries later (e.g., Homer.*Od.*1.272–282, see Chapter 1, this volume). Here is where I depart from the physical constraints on tombs and travel onward to the cognitive decisions that shaped their material form.

2.3. Sponsor's gamble

Conceptualising tomb shape and scale seems intuitively simple at its extremes, from the minimal pragmatic pit for disposal of remains to a multi-story mausoleum's statement of memorial and solidarity. What lies between—the expected standard—bows to contextual circumstances with limits on individual innovation and acceptable space. The balance lies with creating a tomb that fits, investing in a memorial that elevates successors to the deceased. The truth of their position may be stretched with a bigger or better-built tomb, so long as the temptation to inflate does not lead to an outrageous lie. As seen with the opening quote to Chapter 1, Telemachus mourned his father's disappearance for the absence of a glorious tomb, which damaged his prospects as well as his father's memory. Leading small but strategically positioned Ithaca afforded Telemachus some room to dream without overstepping his people's willingness to forget a ruler in absentia. Recalling ancestors with funerary architecture would motivate more than the sons of leaders, just to a humbler scale as risk outweighed advantage for an overly grand tomb. Taboos tolerate only slight deviation from cultural blueprints that impose order to protect health and spiritual wellness in disposing of the dead (Oladepo and Sridhar 1985: 219). With this in mind, the cognitive picture of tomb shape originates in a dialogue between cultural conceptions and techno-environmental constraints.

First, looking backward from what remains, hindsight tracks value ascribed to tomb shape and scale. The central assumption is that tomb construction projected some advantage, now partly captured as inheritance (e.g., our glorious past). Of those not hidden and forgotten, tombs—temples, public spaces, etc.—survived partly due to the affordances made by later generations, who could link iconic architecture and imagined cultural ties with new political regimes. Maran (2016: 153, 161) highlighted construction sequences superimposing structures on places of aged significance at Olympia (Protogeometric sanctuary over an EH II tumulus), Lerna (Early Mycenaean shaft graves over EH II tumulus capping the remains of the House of the Tiles), and Tiryns (LH III *megara* over the EH III/MH tumulus capping the remains of the *Rundbau*). With 700–1,000 years separating the structures, the strength of the relationship is unclear despite the telling placement and possibility for narrative persistence in oral traditions (Maran 2016: 153). Written examples of (re-)claiming monuments, however, dispel doubts over the durability of cultural memory, even if re-invented. Classical stone inscriptions commemorating those involved in financing and organising temple-building, for instance, created lasting reminders claiming the work, which in the absence of living memory and written records could be re-appropriated by any charlatan with something to gain (Burford 1969: 84–88). That relationship between the monumental built environment and people claiming it was in continual transition, flowing into contemporary imaginations or ebbing into the background (Osborne 2014: 3–4). Aspiring leaders, consciously or not, foregrounded monuments as "timemarks" or "links to the ancestral world" and legitimated through invented ties (Holtorf 1996: 127, with references). What they invoked is a form of adapted recall, bending cultural memory with the gravity of emotive scale and persona, seen *in extremis* with megalomaniacal or, in the modern sense, nationalistic pursuits. Incorporating anachronistic symbols from a multitude of eras in the Aegean past,

the Tomb of the Unknown Soldier in Athens commemorates the anonymous dead from wars for territorial expansion in the nineteenth and early twentieth centuries (Davis 2007: 240–245). The message is one of unity in a collective past, wherein the sense of an unbroken inheritance is fabricated for the benefit of the modern state. As Davis (2007: 245) indicated, however, fragmented political allegiances have been glossed over and forgotten in the design. Several German examples of megalith reuse were also tailored to fit nationalistic revivals, but these rely on highly visible monuments that "are simultaneously relics of many ages" (Holtorf 1996: 141–142). Cut or dug tombs, virtually invisible when backfilled to the level of the surrounding slope, cannot generally be incorporated in such a way. One spectacular exception is the evolution of the Danish monument Julianehøf, where a French geometric garden surrounds a prehistoric passage grave (Holtorf 1996: 125). The radical aesthetic shift in purpose owes much to the time gap, with forgetting key in allowing a thoroughly remodelled past.

Recently the process of co-opting monuments has been targeted as part of a "new materialism" elevating objects on a level with human agents (as summarised in Ingold 2012: 429–432; Thomas 2015: 1288–1289). The Latin roots of the word "monument" invoke an active role of reminding observers about a collective past, memorialising an influential persona or a memorable event in an enduring medium (Holtorf 1996: 120; Osborne 2014: 3). To put it another way, existing monuments blend with the social practices and materials of new generations as "entrained action" shaping socio-political trajectories in a manner reminiscent of fluid-sediment interaction—with humans, objects, and environments suspended and colliding in the braided streams of divergent histories (Bauer and Kosiba 2016: 117–120). Simply stated, no single agent takes full control of material design.

Others have referred to the interconnectedness of humans and things as entanglement, but to what extent has not been decided (Harman 2014; Hodder 2012, 2014; Ingold 2008, 2012). For Ingold (2012: 435), interconnectedness is perpetual, and tracking the flow of concept, material, and process embodies a "meshwork", for which the prime analytical tool is, as Miller (2005: 8) puts it, the "material mirror". In that sense, the shape and scale of a tomb mirrors both physical constraints and cognitive decisions. Claiming the advantages of their entangled monumental past, later generations inherited the risks and rewards begun in the original investment and social calculations of the monument builders. Simply stated, the sponsor's gamble was handed forward. Weighing risks and rewards shaped Mycenaean tombs and can be parsed further into semiotic, evolutionary concerns of costly signalling and altruism, to which the following sections turn.

2.3.1. Costly signalling with tombs

Before launching into costly signalling and altruism, I will place explicit limits on how I apply them to Mycenaean tomb shape and scale. I use them more as a pedigree of thought to link the risks and rewards of tomb architecture to a broader theoretical discussion. In this sense I imply only a socioeconomic gamble— commissioners risking resources and reputations—alongside limited altruism from the personal sacrifices made by workers, largely as a factor of time spent. Costly signalling with tombs weighs the advantage of a memorial worth claiming against backlash from, in order of increasing severity, a *faux pas*, reputational or economic ruin, and worker fatalities or uprisings. I disavow the survival game implied by costly signalling's biological origins (e.g., Maynard Smith 1976, 1994; Maynard Smith and Harper 2004; Zahavi 1975), as entangling tombs with reproductive fitness is a bridge too far (see below, cf. Hildebrandt and McGuire 2002; Gat 2006; Lawler 2012). Without omitting where these ideas originated, I tone down the evolutionary implications of costly signalling by exploring its semiotic dimension, from a tomb's intended message onward through its evolving meanings (*sensu* Corbey and Mol 2012; Glatz and Plourde 2011). First, some definitions are needed.

Costly signalling refers to investing resources in a feature that signals strength or vitality, such as a male white-tailed deer growing a large rack of antlers or a bank housing its corporate headquarters in a skyscraper (Carballo et al. 2014; Codding and Bird 2015; McGuire and Schiffer 1983: 281; Spence 1973; Trigger 1990). This

is done despite the liabilities of the feature—the handicap principle (Zahavi 1975: 213)—which paradoxically can also threaten the health and safety of the owner (Conolly 2017: 435–436; Corbey and Mol 2012: 375–376). In the previous examples, this could be hunter preferences for deer with large racks or the bankruptcy risk of failing banks with excessive overhead expenses. Costly signalling thus tracks three principal components: 1) sender/gambler, 2) message/risk, and 3) receiver/judge. With each component the balance between roles is finely tuned, loading even slight variations with the potential for escalating fallout. The costly signal of a strongly deviant tomb would weigh 1) the advantage of political and social influence gained by association with an enduring symbol of wealth and authority against 2) the social and economic risks of expending resources and losing public opinion to a megalomaniacal or garish project. The latter interrogates the authenticity or reliability of the costly signal, assuming those less strategically positioned would not attempt it (Maynard Smith 1994: 1115). Summarised by Grose (2011: 677) under *honest signalling* and corroborated in human social competition as early as 30,000 BP with elaborate stone tools and cave art (Conolly 2017: 440, with references; alternately explained as emblemic group signalling by Gittins and Pettitt 2017: 482), rare or nonlocal items are accumulated and/or destroyed to boost prestige validated by observers aware of the cost. Using these terms, cemeteries—like Portes, see Chapters 4 and 5—capable of building exceptional tombs could avoid the reliable signal challenge by restricting deviation and its attendant socio-economic and somatic risks (see below).

Costly signalling is often invoked when analysing religious architecture and expenses, since the social and economic benefits therein are not always directly clear (Sosis 2003). Questionable investment in landscape monuments from LBA Anatolia also raised the issue of costly signalling in terms of communication among political competitors, particularly in contested areas further away from political centres (Glatz and Plourde 2011: 35–37). As a political cohesion strategy, construction of monuments was considered less costly than military conquest and occupation (Glatz and Plourde 2011: 38). Examining costly signalling in tomb construction involves an analysis of the expected costs, risks, and rewards—in other words, the expected standard to uphold. Commissioning the monument preceded actual (both real and perceived) costs, risks, and rewards—the comparative cost and investment risk—and consequently relied upon a gamble against the expected standard, including materials (building and consumables), animal resources, and human capital. Each of the categories is quantifiable, intensely variable, and combines with intangible factors like reputation and altruism—for the labourers at least—to underwrite construction. As others have indicated (e.g., Conolly 2017: 440–441; Grose 2011: 677–678), costly signalling would be self-fulfilling and ubiquitous without empirical modelling, for which I introduce the relative labour index in the remaining chapters. A recurring problem with tomb visibility, cost, and timing for cemeteries lasting six centuries (Portes and Voudeni, see Chapter 4) prevents a broad reassessment here of costly signalling as a partial explanation for conspicuous consumption in monumentality, especially through the complex failure of smaller sponsors (Conolly 2017: 442; see below). By contrast to the complexity of sponsor failure, altruistic behaviour can be a straightforward fit to the motivations of tomb builders. However, it is far more difficult to model formally without participant observation (e.g., 'ultimatum' and 'dictator' gaming decisions, Fehr and Fischbacher 2003: 786–787; see below).

Altruism involves the sacrifice or weakening of self-interests for the benefit of others (Fehr and Fischbacher 2003; Trivers 1971). The action need not be entirely selfless, as deferred benefits could rebound on the weakened position, and the behaviour could be conducted with this in mind. Forethought for recompense or the maintenance of reputation by avoiding the opposite of altruistic behaviour, known as cheating or free-riding (Fehr and Fischbacher 2003: 788), could influence actions just as strongly as deeply held convictions (e.g., honour, valour) used by cultural materialists to explain similar behaviour in exchange (Corbey 2006). The highest reward potential comes not from avoiding cheating altogether, but avoiding being caught in deception (Grose 2011: 685) or altruistic punishment (Fehr and Fischbacher 2003: 786–787), a risk-reward scenario popularised in game theory. Statistically, equivalent retaliation ("tit-for-tat") is more beneficial than acting altruistically, even if this only means a partial or temporary loss in self-interests. Cooperation has been shown to decay as optimism in group participation declines—even with high proportions of "strong reciprocators" vs. "non-cooperators"—unless reputation and punishment influence behaviour (Fehr and Fischbacher 2003: 788–789).

In biology and evolutionary archaeology, altruism is a factor in increasing fitness through the preservation of genes, such as that which motivates kin selection, or allying with blood relatives. The semantics of these and closely related biological terms like mutualism has been a source of confusion when testing the fitness limits of cooperation among humans and non-humans (West et al. 2007: 415). For human behaviour, "costly prosocial behaviours" like feasting have been targeted to find where extended benefits arise from temporary shortfalls to individuals and groups (Conolly 2017: 437, with references). The impetus of altruistic kin selection decreases with distant relatives and strangers, shifting actions of communal labour among non-relatives into the weaker but still-present selection preference for community. Economically and socially, altruism underlies exchange, reciprocity, and cooperation (e.g., Ellen 2010; Granovetter 1992; West et al. 2007). For the built environment, altruism manifests as communal cooperation in architectural efforts that exceed the capabilities of a single nuclear family. In this sense, monumental tomb construction benefited community participants by increasing their monumental capital (with sponsors' reputations receiving an outsized share), reinforcing social advantages through physical presence and mythical tradition. Later fortifications and public works joined costlier tombs in staking claim to territory and cultural inheritances. Explanations for similar over-the-top investment can follow group reinforcement, as in the case of emblemic Palaeolithic Lascaux cave art (Gittins and Pettitt 2017: 470), or assertive displays from strong sponsors like the proliferation of island hillforts looming over the Bronze Age eastern Adriatic (Čučković 2017: 528). For Mycenaeans and their cultural heirs, perception of strong walls and elaborate tombs granted advantage (value/prestige/power/influence/memory) to noticeably costly affairs.

Each substantial building project required some form of cooperation or altruistic labour, as compensation for workers would inevitably leave a short-term deficit for those sacrificing time or resources. Mycenaean labourers may have undertaken that sacrifice to increase prestige or cement hereditary claims for elite groups, tying them to memorable tomb projects with oral legacies. Santillo Frizell (1998: 103–107) emphasised this as a motivation for the construction of the Atreus, Clytemnestra, and Lion *tholos* tombs at Mycenae and compared their spectacle with the transport of the red porphyry sarcophagus of Swedish King Charles XIV in 1856. Participants dragging the 11-ton coffin and 5-ton lid were dubbed the "Royal Horses", and family legends continued to celebrate any ties to the event nearly a century and a half later (Santillo Frizell 1998: 107). More recent examples of altruistic labour highlight the difficulties faced by political and economic asylum seekers with suppressed legal rights and wages (Garcia 2006: 28). Altruistic labourers tolerate the deficit with the hope for long-term economic stability and societal integration, advantages also weighed by unforced workers prior to the commodification of labour.

With the above constraints in mind, the impetus at the root of Mycenaean tomb construction is semiotic and evolutionary. In other words, tomb construction conveyed meaning to observers and aimed to advance the interests of investors—those associated with commissioning and organising building rather than the builders themselves (Santillo Frizell 1997–1998: 103). As summarised by Osborne (2014: 6), monumental tombs and monuments in general have been cast as expressions of territorial control and political power (DeMarrais et al. 1996: 18; Glatz and Plourde 2011; Schnapp-Gourbeillon 2016: 207), social complexity and identity (Renfrew 1983; Sherratt 1990), and benchmarks of scale for power and labour mobilisation (Abrams 1989, 1994; Trigger 1990). Each of these indicate advantage for the sponsors, with a less direct link to motivating labourers. Methods tracking labour mobilisation and the construction process feature prominently in Chapter 3, but the advantages conveyed by commissioning construction are the focus here. Commissioning monuments and funeral activity are exceptional events (Boyd 2014a: 194), elevating the impact of monumental tombs on social memory most prominently during the spectacle of construction. Why launch that spectacle?

For monumental tombs, exceeding any practical dimension of mortuary necessity as in Trigger's (1990: 119) thermodynamic definition of monumental building, construction is often translated as a performative message meant to have an audience, similar to the "performative space" provided by Mycenaean citadels (Maran 2006b: 76; Wright 1987: 176). The message of monumental tomb construction is less one of grief and remembrance

for the dead than it is one of attention-grabbing and improvisation among living actors (Boyd 2014a: 194–197). From a Darwinian or evolutionary stance, costly signalling and altruism theories offer motives for monumental tomb construction, with definitions and examples above. The concepts will be familiar to researchers in the Aegean, but the terms are different. Cooperation, competition, and consumption, for instance, are proximal explanations addressing the same cultural phenomena as costly signalling theory (Conolly 2017: 435). Rather than power (e.g., Cavanagh and Mee 1999: 93; Maran 2006b: 76; Voutsaki 1995: 62, 1997: 44–45; Wright 1987: 176) or wealth (Shelmerdine 2006: 84; Voutsaki 2001: 204), tombs reflect advantage in the scale and quality of construction. More importantly, the contextual details of Mycenaean funerary performance, so difficult to reconstruct from partial evidence, are less critical than the comparative empirical benchmark set by tomb scale. Instead, analogies to relevant scenarios fill in the gaps throughout the long monumental past of human engineering, calling upon evolutionary and architectural theories as anchor points.

2.3.2. Risks of investment: the expected standard

The combination of costly signalling and altruism theories has been used before to explain motivations for warrior displays in literary texts, notably the Anglo-Saxon folk classic Beowulf (Corbey and Mol 2012: 375). Boastful and arrogant, the Geatish hero Beowulf reflects the concerns of the Anglo-Saxon aristocracy and its preoccupation with young retainers making bold (altruistic) gambles to increase their leaders' stocks as well as their own. Beyond being technically functional tools in the hands of proficient warriors, elaborate armaments signal to others that the bearer is formidable and their leader generous. Focus is easily shifted from those bodily ornaments in Anglo-Saxon folklore to over-the-top architecture in multiple burial contexts, as Beowulf's earthen tomb makes an enduring statement of its own (Milner et al. 2010: 110–111; Williams 1998: 91). The Treasury of Atreus at Mycenae loudly proclaims a similar message, one that no other tomb before or after could equal (Mason 2007; Wace 1940: 233).

The bold step of diminishing the visual impact of smaller previous tombs with larger and better-built ones risked criticism from economic and social conservatism, a famously restrictive mechanism in Egyptian engineering and medicine (e.g., Cotterell and Kamminga 1990: 60–61; Ritner 2000: 107). Bierbrier (1982: 14) blamed "religious conservatism" for delaying major alterations to traditional pyramidal tombs as late as the early Eighteenth Dynasty. Conservatism also manipulated Mycenaean funerary rites, particularly regarding the scope and material requirements of processions (Cavanagh 1998). Late Helladic I ceramics from Portes reflected a preference for conservative forms over contemporary wares from similar tumuli at Samiko and Makrysia in Elis (Moschos 2000: 16). That resistance to change stemmed from tradition, collective beliefs on acceptable architectural and artefactual forms and ritual prescriptions. In the case of chamber tombs at Voudeni, variation in vault shape was hidden from view by closed entrance passages that largely do not vary except in size. Differences of form and scale could go largely unnoticed by casual observers unable to access the interior of the *dromoi* and vaults. At Portes, vault shape was similar, but the chamber tombs were not the only grave types present, being joined by two *tholoi*, tumuli, and multiple built chamber tombs and cist graves. These changes are far more noticeable and reflect several centuries of use, with different generations focusing on their own preferred tomb types, though not to the exclusion of others (see Chapter 4).

Although an evolutionary perspective recasts Mycenaean funerary performance in this section, I reiterate here that reproductive motivations are not considered to affect mortuary behaviour, as has so often been the case in the famous debate over violence (e.g., Gat 2006; Lawler 2012). The advantage relies upon social (political and economic) advantage and the somatic—that is, bodily upkeep—rewards that it precipitates, driving the enterprise's evolutionary success. These rewards arise from the asymmetric exchange of communal labour for monumental construction, not unlike the asymmetric gift exchange and conspicuous consumption that Voutsaki (1995, 1997) highlighted as critical in early Mycenaean elite competition.

Larger, better-built tombs benefit those closely associated with their commissioning and use more than those fulfilling basic construction roles, but the latter also see some returns for their inclusion (and sacrifice) over non-participants (e.g., Santillo Frizell 1997–1998: 103–107). In the Shaft Grave period, elites benefited from elaboration of burial ceremonies and increasing scale of architecture as proof of their control over resources (Dabney and Wright 1990: 50–51; Fitzsimons 2011: 78). In the proliferation of tomb forms to encompass monumental *tholoi* and chamber tombs, competition can be read into conspicuous displays from gift exchanges and labour mobilisation (Voutsaki 1995: 62, 1997: 44). Grave goods of rare and expensive items taken out of circulation in the closing of Mycenaean tombs depict an accumulation of wealth and the willingness to sacrifice it to gain influence, bolstered as family members and close associates maintained an indirect claim to the material (Voutsaki 1997: 38). For modern analogies with estimated net worth of nearly $300,000 each, multi-storey tombs of cartel leaders at Jardines del Humaya near Culiacán, Mexico, reflect both a massive accumulation of wealth and, with the inclusion of air conditioning, an unwillingness to forgo luxury even in death (Mendoza 2017).

With the potential to derail any advantage in the costly signalling competition of elite architecture and conspicuous consumption, excessive ostentation risks reputation. This is best captured by the term "folly", which so often accompanies spectacular failures or useless endeavours. Quoting Stuart Barton, Howley (1993: 2) highlights the dual definition of an architectural folly, either celebrated as pleasing for the sake of it or derided as "foolish monuments to greatness and great monuments to foolishness". Many examples survive from the British Isles and sustain a form of landscape tourism in Georgian, Victorian, and Edwardian gardens. One that has not survived, known as Beckford's Folly, enshrines the commissioner (William Thomas Beckford) rather than the architect (James Wyatt) as the guilty party behind a famously short-lived Gothic tower, despite the latter's experiments with "compo-cement" that ultimately doomed the structure (Wilton-Ely 1980: 45–46). Wilton-Ely (1980: 46) referred to it as a form of "poetic justice" when Wyatt later earned the epithet "the Destroyer" for his "vigorous restoration of ancient buildings". In the discussion of negative reactions on elite architecture to follow, commissioner and architect would share the blame. Unlike a tower's sudden disappearance from the local skyline, however, a tomb collapse even of a similar magnitude might not send reputations plummeting. The collapse, after all, would largely be hidden from view, and collapse layers overtopped by Mycenaean materials show it did not deter reuse (Cavanagh and Mee 1978: 42; Smith and Dabney 2014: 151–153). A tomb's costly signal is worth the risk so long as the spectacle veers toward the positive side of folly, invoking festive appreciation as a memorable venue for a feast or contemplative reverie in memory of the deceased (e.g., Hamilakis 1998: 117–120, with references).

Long-term advantages driving the costly signalling of Mycenaean tomb construction included boosts to local economies and personal reputations, whether from the spectacle of construction (Fitzsimmons 2006: 188; Santillo Frizell 1997–1998: 103), procession and orientation relative to potential spectators (Boyd 2014a: 194, 2016: 64–70), or the completed (and enduring) monument (Wright 1987: 181–182). That potential growth in economy and reputation encouraged increasing the size and quality of tombs, within the limits that convention or ability allowed. When compared with previous examples in Grave Circle B at Mycenae, groups of larger tombs like those in Grave Circle A reflected a successful faction's control over more resources (including labour) than their predecessors (Fitzsimons 2014: 91). Mycenaean palatial complexes functioned in a similar fashion with imposing Cyclopean stone fortifications and gateways geared towards impressing viewers through their contrast with the small stone and mud-brick architecture of contemporary housing (Maran 2006b: 79). Cost set them apart and attracted envy among peers and subordinates. The citadels also directed views or restricted access through closed courts and corridors (Cavanagh 2001: 124; Maran 2006b: 80), a task for which the entrance passages of Mycenaean chamber and *tholos* tombs excelled (Papadimitriou 2015: 72).

Negative associations can also rebound on monumental construction—unravelling the original intention of the costly signal—with the majority of ill-feeling falling on architects and dictators more than engineers and labourers (e.g., Bretschneider 2007: 4; Davis 2007: 251, citing Petropoulos 1996: 243–245). Iconoclastic van-

dalism has often answered public fervour against failed regimes, seen most recently in the targeted bombing of high-profile buildings and dramatic toppling of towers and statues to dictators in the past 70 years (Bretschneider 2007: 8; Davis 1991: 90). In a classical parallel, the vulnerability of Roman imperial memory compelled successors to destroy images and control mourning, as in the case of Domitian and the *damnatio memoriae* (Reitz 2013: 202–203). Many Egyptian regime changes also famously resulted in the effacement of names from existing monuments, whether to aid the claim of the new leader or erase memory of a previous one. Perhaps with multi-semiotic intent, the late construction of Building T atop the Tiryns citadel left partially visible the ruins of the Great Megaron (Ann Brysbaert, personal communication 2018; Maran 2016: 168). Enduring theories addressing the conflagrations at palatial centres near the end of the LBA suggested internal unrest, possibly related to a population overstretched by the demands of building, as one of many sources for collapse (summarised in Knapp and Manning 2016: 123–124). If that was the case, few clearer messages could be sent against the ruling elite than to attack the costly signals synonymous with their authority.

Apart from long-term advantages and enduring social memories, monumental construction spurs some immediate responses. Among the immediate somatic rewards conferred by Mycenaean tomb construction, a concentration of resources occurred that demanded rapid allocation. Some resources were redistributed to sustain construction. Others were consigned to the tombs and removed from circulation. Feasting and votive offerings fell within the latter category. Giving an idea of the resources involved, some records of grain allotments and substantial herds administered by palatial complexes were fortuitously preserved in catastrophic fires at Pylos, Knossos, and Thebes (Palaima 2015). Others have suggested the decentralised control of substantial resources among sanctuaries and districts (s. *damos*) with mayors (s. *ko-re-te*) and vice-mayors (s. *po-ro-ko-re-te*) (Lupack 2011: 212). After palatial administration and monumental architecture ceased before the LH IIIC period, market exchange assumed primacy in the crafting and movement of prestige items and commodities (Pullen 2013: 443). Who controlled the resources is not as imperative here as the timing of allocation during building programmes, which could face significant delays if the somatic needs of labourers were not met in a timely fashion. Consequences could range from work stoppages to violence. These are outlined further as part of the risks of costly signalling and altruistic labour exchange in tomb construction, borrowing examples primarily from mining prior to early industrial labour reforms.

2.3.3. Cost and altruism in cooperative labour

To reap the rewards of costly signalling in monumental tomb construction, commissioners would risk personal reputation and local resources, as outlined above. In extreme conditions, the lives of workers were also at stake. Since no account of conditions or labour rights in Mycenaean tomb construction survives, analogy is necessary to explore the upper limits of management concerns for physically demanding labour with underground installations. It must be stressed that the conditions are analogous and not identical. For instance, unlike for lengthy tunnels and mines, separate ventilation shafts would not be as imperative for comparatively shallow tombs. Shoring of walls to prevent collapse, however, would be a shared concern among all underground operations, as would somatic requirements to sustain the health and safety of participants. For instance, Roman building manuals highlighted the need during the digging of wells to protect workers and prevent collapse by shoring walls with vertical wooden planks reinforced by horizontal cross-ties (Plommer 1973: 51). Mycenaean builders deployed temporary wooden framing in "pier-wall construction" to set walls, as seen in the Palace of Nestor (Blackwell 2014: 477 citing Nelson 2001). Examples of failure in meeting the somatic requirements of workers are prevalent in Classical accounts of slave uprisings, as well as the labour reforms of the nineteenth and early twentieth centuries (see below). What led to these reforms are some of the worst conditions ever recorded for manual labour. Many incidents involved mining operations, already risky enterprises for their substantial physiological and logistical demands. Shifting materials in subterranean passages required coordinated efforts to keep bodies in motion and prevent collapse.

Off-site, the workers had to be paid, housed, hydrated, and fed. For wage economies, these costs are easily traced in epigraphic evidence. From the second millennium BC, Egyptian and Near Eastern texts reflected suppressed wages in silver or their equivalent in grain (namely barley or wheat) allotments (Scheidel 2010: 439–440). Wages among unskilled workers in the early Roman Empire varied according to location but were comparable when linked to the local cost of wheat (Temin 2004: 519). Miners were compensated according to production in AD 164, sharing risks through contracts with employers (Temin 2004: 520). Signalling the Roman economic pillar of slavery, Plommer (1973: 8) referred to simple machines, even the *torcularia* mechanical presses, as little more than "expensive toys," using as his example Palladius (I, 18) calling for a *calcatorium* (treading floor) over the press advocated by Vitruvius. Similarly, long-term contracts for hired labour in fifth-century BC Athens had to be weighed against the upkeep for slaves performing similar tasks (Loomis 1998; Silver 2006: 259). Assuming illiteracy was the norm in the LBA Aegean, any compensation for workers would rely on verbal understandings. Even in the unlikely event that conscripted labour was used in constructing monumental tombs, workers would still require substantial upkeep to divert counterproductive losses in ability or morale.

If providing ample food and rest guarded labour readiness, entertainment also diverted unrest, the recurrent *panem et circenses*. From a costly signalling and altruism perspective, few other categories of expected costs, risks, and rewards better highlight the disparity between commissioner and labourer (e.g., Murphy 1997: 51). Amassing support for infrequent events, the question of downtime loomed large for communal building projects in antiquity. If part-time specialists and travelling architects were employed to construct more refined tombs, as suggested by Boyd (2002: 61–62) for the large chamber tombs at Volimídhia and the rapid proliferation of the *tholos* tomb form from Messenia, tomb construction would not preoccupy anyone for long. Idle tomb builders flooding labour markets were not a plausible concern, unless work coincided—and competed—with contemporary public works. Roman efficiency in diverting labour resources provides one possible solution through strategic scheduling. Peacetime armies provided frontier labour throughout the empire, building public works for diversion and avoiding disruption of civilian labour markets (Temin 2004: 522). During the Irish famines of the eighteenth and nineteenth centuries, starving sharecroppers were redirected by landowners and government officials to build follies—roads to nowhere and elaborate buildings without purpose—to avoid direct handouts (Howley 1993). Mycenaean leaders could deploy similar tactics with unused labour if the need arose. Unfortunately for those leaders, both action and inaction with large groups could invite one of many demographic crises, sanitation first among them.

Beyond payment, subsistence, and diversion, construction programmes required adequate sanitation to ward off disease, a threatening equaliser for preindustrial costly signalling. Early urban contexts struggled for sanitation solutions with densely populated areas. By the late third millennium BC in Mesopotamia, Akkadian texts linked toilets and rubbish heaps to demons and blamed disease as bad luck brought on by divine disfavour (McMahon 2015: 21). Even so, building projects related to public utilities were not prioritised by rulers, and the bulk of responsibility fell on individual households (McMahon 2015: 19). Plumbing in Minoan palaces prioritised clean water and adequate sanitation, but public systems, like that in the crowded streets of Late Minoan Gournia, were improvised (Arnott 1996: 266). Streets were common catchments for waste in Classical Athens, collected by cleaners and reused in part as fertiliser (Jameson 1990: 110). Millennia later, the debilitating power of poor sanitation remains prominent, especially where events conspire to concentrate labour resources (e.g., Friedgut 1987: 249–250). For the Aegean, the consequences are evident in several cases since the Early Bronze Age. The mass burial of 12 individuals capped by a tumulus at Thebes in the late Early Helladic II period (ca. 2200 BC) revealed no outward signs of "long-term pathologies or trauma", reflecting a rapid event (Vika 2009: 2024–2025). Likewise, the Late Helladic IIA/B mass burial of 11 individuals at comparatively rural Nichoria in south-western Peloponnese suggested the possibility of an unknown epidemic (Arnott 1996: 265–266; Boyd 2014b: 197–198). More than a millennium later, Athens withered under a multi-year outbreak (ca. 430–426 BC) that killed thousands, felling their leader Pericles and leaving a mass grave of at least 150 at Kerameikos

with three apparent carriers of typhoid fever (Papagrigorakis et al. 2008: 162–166). Overall, causes for the sweeping scale of the epidemic are still contested (Littman 2009: 456–459, 465–466).

The spread of many infectious diseases is unconsciously self-inflicted. As mentioned above in early land modifications, deforestation starting in the Neolithic could have contributed to a rise in malaria (Angel 1972: 90). Research into ancient DNA could revise the malaria hypothesis and proposed genetic disorders like thalassaemia in favour of iron-deficient anaemia acquired through poor diet (Chilvers et al. 2008: 2707). Without soft tissues and written records, only pathogens that leave signatures on bones can be identified here. Typhoid, smallpox, and cholera are conjectured throughout the early urban eastern Mediterranean but cannot be proven (Arnott 1996: 265). Pathological evidence from skeletal remains, sparse as it is from the LBA, cannot be linked conclusively to labour requirements temporarily increasing local population densities. It is possible that specialists and traders travelling from overseas could have brought pathogens with them, as happened during the devastating early medieval pandemic of mid-fourteenth century Europe. Larger Mycenaean settlements were famously connected to sea routes and materials from abroad, including potential pathogens. An influx of labourers was likely not necessary for tomb construction, but concern over sanitation is no less valid for locals brought into close contact for longer-running projects. Paradoxically, outbreaks could also improve circumstances for surviving workers. When the Antonine plague (AD 165–175) thinned the available labour pool in Egypt, wages doubled (Temin 2004: 519).

Compounding the risks from rapidly spreading epidemics, diffuse assaults on the health of workers could originate in the air itself. As with all underground work, long-term health risks resulted from poor air quality in enclosed spaces. Records for at least two millennia showed the diversion of substantial resources to ensure breathable air during tunnelling and mining. For example, from AD 41 to AD 52 under Emperor Claudius, the 6 km tunnel draining Fucine Lake into the River Liris prompted the sinking of ventilation shafts for each of the 40 vertical tunnels facilitating the removal of water and rock for the main channel, increasing costs substantially (Reitz 2013: 68–72; Thornton and Thornton 1989: 61–63). Given the consequences of inaction, this was not excessive. For the beleaguered early twentieth century copper miners of Montana, for instance, federal investigators found that 42% of Butte miners examined in 1916 suffered lung scarring from exposure to silica dust (Murphy 1997: 18). Lighting and ventilation were especially problematic prior to electrical lights and fans. Classical regulations in the Laureion mines near Athens attempted to limit the smoke from oil lamps with the threat of severe penalties for contractors (Marmaras et al. 1999: 362). Complications from lighting using open flames likewise jeopardised excavators of the pier foundations for the Brooklyn Bridge, with Washington Roebling's solution of shorter, vinegar-soaked wicks and alum-mixed tallow failing to alleviate concerns for ventilation (Fitchen 1986: 190). Prevalent in each tomb modelled during this study, a damp musk signalled exposure, however slight, to mould and bat faeces. Both are later additions, products of post-excavation conditions ideal for the new residents, but stale air would still greet entrants to vaults closed for months or longer. Digging the tombs in warm and dry conditions would also ensure inhalation of airborne particulates. Apart from a temporary inconvenience or general anxiety for proximity to the dead (see below), tomb construction would be sufficiently staggered (brief in duration and separated from other tomb construction) to limit connections to direct health consequences. A more easily recognisable hazard would be sudden injury, particularly that threatened by collapse under construction.

Visible in the short term and evincing emotionally charged responses that can culminate in full-scale rioting, accidental injury reduced the available labour pool and strained relations between workers and organisers. Incident rates from rapidly industrialising economies near the turn of the twentieth century show worst-case scenarios that are unlikely to have occurred frequently in prehistoric regional projects. For example, accidents injured as many as one-third of miners in the Donbass region annually prior to 1896 (Friedgut 1987: 246). Between 1914 and 1920, 559 miners in Butte suffered fatal accidents with falling rocks and mine fires (Murphy 1997: 18). Of the limited skeletal material that remains from the LBA, sudden injury and its causes are difficult to identify with certainty. Relating more to disease susceptibility, as discussed above, some data is available on

malnutrition and anaemia through porotic hyperostosis, but not on the levels seen in the New World (Angel 1978; Buikstra and Lagia 2009: 15). Not surprisingly, there is a noticeable drop in the incidence of dental and skeletal indicators of malnutrition among the better-fed Mycenaeans in Grave Circle B (Arnott 1996: 266). Wear and tear from vigorous activity, however, is more evident in arthritic joints and traumatic fractures (Arnott 1996: 266; Buikstra and Lagia 2009: 17). Setting and immobilising bone fractures for healing seems to have been a common practice by the LBA, as well as the successful application of trepanation, including the example from the Agia Triada cemetery in Ilia (Arnott 1996: 268; Mountrakis et al. 2011). So long as complications from infection did not arise, Mycenaean healers could restore injured labourers in a matter of months (using the 12-week average cited by Arnott [1996: 268] for healing fractures).

As a final aside to tomb commissioners' preoccupation with designing the most advantageous form within their means, steps had to be taken to alleviate necrophobia among locals living or working in the vicinity of the tomb. Blocking the *stomion* served a dual purpose of limiting access from living intruders as well as the escape of vengeful spirits (Tsaliki 2008). As Boyd (2002: 83) puts it, the blocked entrance served as a liminal space "where the dead are transformed from recognisable corpse to part of the ancestral mass…[and]...where the living might go to stand on the edge of the world, at the interface between the living and the dead, to confront through the remains their beliefs about death and, if any, the afterworld". Large chambers and lavish gifts would further appease the interred and ease the minds of survivors. The location and orientation of the tombs may have been planned with local eschatology in mind, avoiding malevolent spirits among the living by following a particular spatial format (Mee and Cavanagh 1990: 226–227). At the same time, close association with the tombs of celebrated ancestors could advance the aims of living descendants through proximity to the tombs and the grand memories they recalled (Fitzsimons 2007: 114).

2.4. Summary

If the above discussion serves as any indication, tracking the costly signalling of monumental tombs and the altruistic sacrifices of their builders is no simple task. Quantifying the labour and resources directly involved, however, represents a step in the right direction. Prominent Mycenaean multi-use tomb styles evolved with passing generations, roughly progressing from tumuli to *tholoi* and chamber tombs between the seventeenth and fifteenth centuries BC (Section 2.1). During the following two centuries, the largest known *tholoi* were built near major citadels while chamber tombs of all sizes proliferated across southern Greece. Local geology encouraged experimentation with rock-cut tombs that mimicked the designs of *tholoi* at a much cheaper cost, opening participation in derivative mortuary legacies to less influential families (see Section 2.2; Chapter 4). Choice in which tomb shape and scale to follow amounted to a sponsor's gamble in the theoretical language of costly signalling and altruism (Section 2.3).

An empirical framework for measuring costly signalling among commissioners and altruism among builders recasts the decision to invest in multi-use tomb construction as a risk. Commissioners risked resources and communal support, while tomb builders ran a deficit of time spent on the legacy of others. Witnesses would weigh the authenticity of a tomb's type and scale against the position of the deceased and their followers. While a well-received tomb at the edge of social tolerance could boost support, overstepping expectations with too large a tomb might tarnish the memory of the deceased and undermine the influence of survivors. Too rapid a change in style would also raise eyebrows, throwing group identity into question. The first to build a local *tholos* or chamber tomb where earlier types predominated must have wagered this choice with witness opinion in mind. Upstaging a more powerful lineage with a mismatched tomb could upset the local order, a step not lightly taken for those expecting or experiencing loss and shifting roles (see Chapter 5). Social limits—rather than physiographic (Section 2.2) or economic constraints (Chapters 3 and 4)—restricted the scale at which tombs could be built. This chapter provided the theoretical basis for that judgment, while the following chapter grounds it with comparative earthmoving, energetics, and a relative index for pragmatically tracking signalling with tombs.