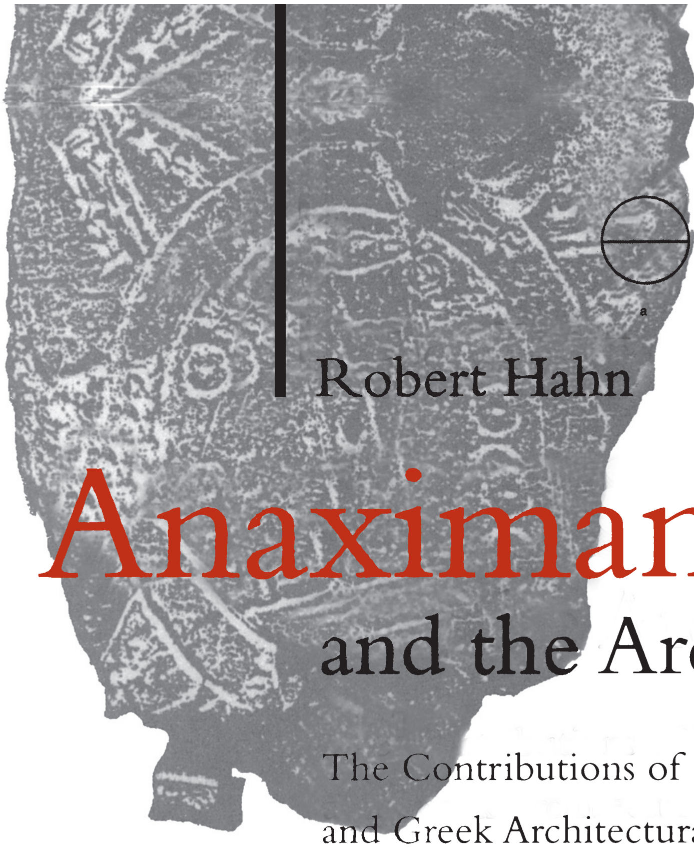
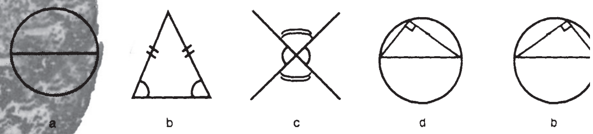
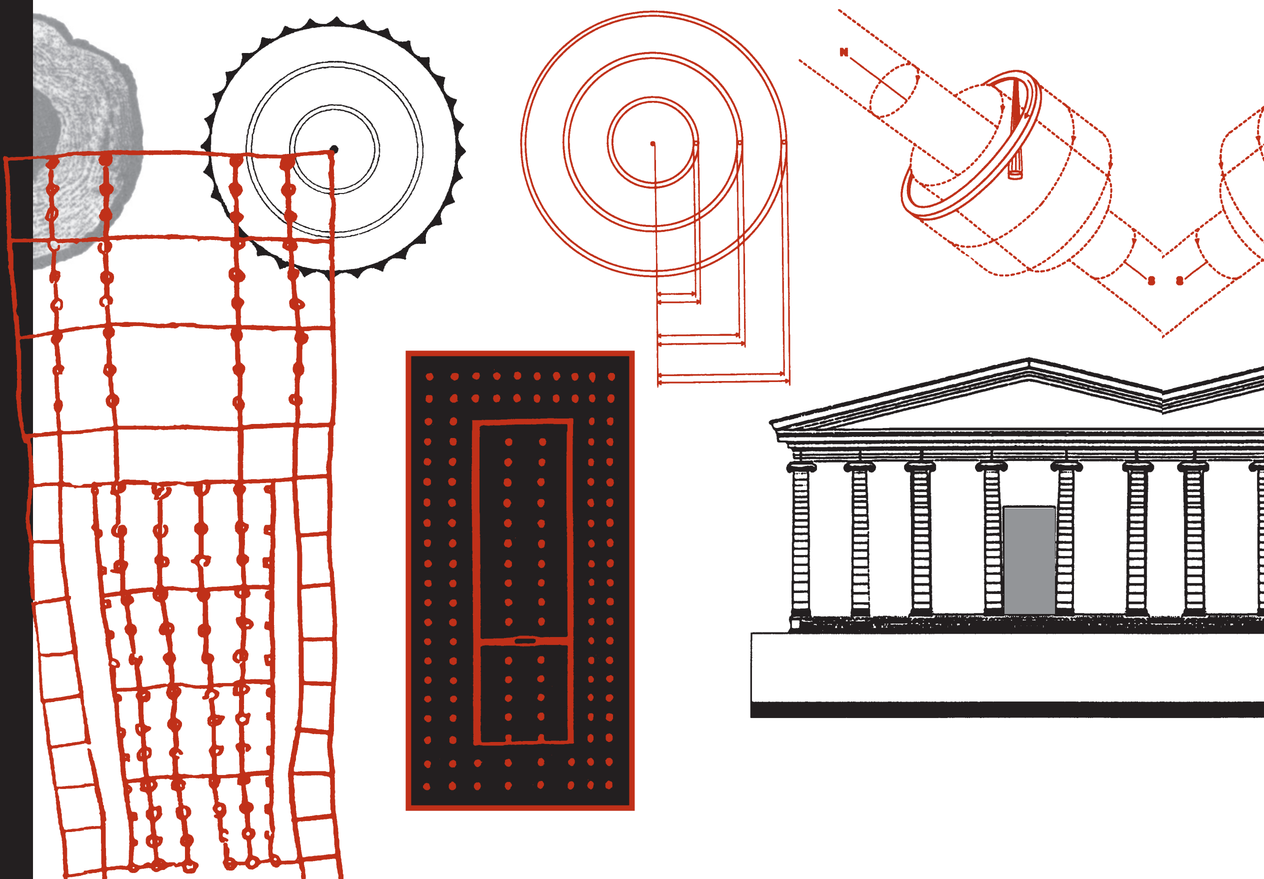





Robert Hahn

# Anaximander and the Architects

## The Contributions of Egyptian and Greek Architectural Technologies to the Origins of Greek Philosophy



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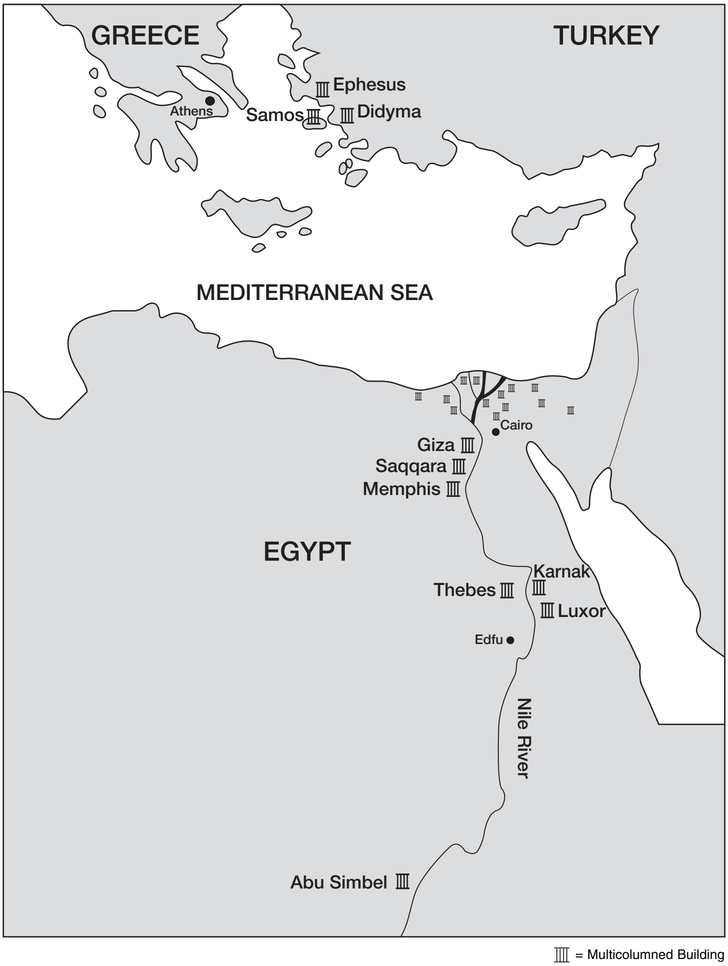


*Mediterranean, indicating multicolumned temple sites in Egypt and Ionian Greece as of sixth century* BCE

SUNY SERIES IN

ANCIENT GREEK PHILOSOPHY

Anthony Preus, editor

# ANAXIMANDER AND THE ARCHITECTS

ROBERT HAHN

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# *Preface*

For readers who are familiar with studies in early Greek philosophy, I think they will find this to be a most unusual book. First of all, the book explores the contribution of technology to the origins of philosophy, a theme that has rarely been pursued. Among those who have explored its possible influence, to the best of my knowledge, none has investigated the architects and their monumental projects in a full-length study. Moreover, this book is broadly interdisciplinary in its approach, and unlike conventional studies where images are conspicuously absent, the persuasiveness of the argument rests, in large measure, on appeal to the visual evidence. Finally, for all scholars who have bemoaned the predicament of relying ultimately on the fallible doxography and exegesis of Aristotle and his school to gain insight into Presocratic thought, this book opens a new source of light into the subject that does not depend upon them. This study, then, seems to me to be unusual in several ways. The book explores the relation between the early philosophers and craftsmen and it investigates architectural technologies and traces their transmission from Egypt to Greece. It invites the reader to connect Anaximander's (and Thales') efforts in geometry, astronomy, and terrestrial and cosmic cartography to those technologies, and it attempts to place these activities within the social and political framework of archaic Greece in which these developments unfolded. The evidence, bypassing Aristotle and his successors, comes directly from archaic Greece.

In order to understand how this unusual project came about and developed, it is useful to explain my long romance with Greece. In the mid-1970s I had written a dissertation on

Plato entitled *Did Plato "Schematize" the Forms?* Inspired by a problem formulated by Kant and developed by Heidegger, my dissertation, directed by Karsten Harries at Yale, explored the relation of structure, value, and time in Plato's later dialogues. Like many of my colleagues who studied ancient philosophy, however, I had never visited Greece. Indeed, while the general view I encountered at this stage of my studies was that a visit to Greece might enliven and broaden my interests, most of my philosophical colleagues were not of the opinion that a visit to Greece would likely prove to be *philosophically* enlightening. I attribute this disposition to the general philosophical attitude, at least then, that as one of my esteemed colleagues later put it, "philosophy lives a supracelestial life beyond the confines of time and space." And hence, one could study Greek philosophy as effectively in the basement of an American library as in Athens or on the islands, and perhaps even more so since one would not be distracted by spatio-temporal contingencies such as the blue sky and sea. Thus, the visit to Greece did not seem then to be indispensable to a deep understanding of the ancient Greeks. An important exception to this prevailing attitude found expression in the work of another one of my teachers at Yale, Robert S. Brumbaugh, a man who influenced me in ways I could not have foreseen at the time; he emphasized both the importance of travel through Greece and the role of technology for understanding Greek philosophy.

My research took on a different approach from 1980 onward, and this book is a fruitful consequence of it. That was the year I accepted an invitation to be a Visiting Professor at the American College of Greece. A few days after arriving in Athens, I travelled to a famous archaeological site; I will never forget my first visit to Delphi, for it changed my academic life in an important way and yet in a sense that I never anticipated. Although I had studied Delphi in an archaeology seminar, I was completely disoriented when I entered the site. Since I had only planned a day-trip from Athens, I found that I wasted too much time simply trying to find my way around. I left the site that day with a mixture of astonishment and frustration. For in those days before CD-Rom and Perseus II, I had great difficulty translating the flat pages I had studied into the three-dimensional site through which I walked. And while I was amazed by the power I felt at the site and in the presence of the antiquity of the ruins, I also felt that I had not used this precious time effectively.

When the opportunity presented itself again, at Easter break, to explore the Minoans in Crete and Santorini, I planned differently for these visits. Thanks to the generosity and *philoxenia* of my Greek hosts, I was able to organize a little *pareya* of colleagues and students for a seven-day excursion. Consisting of an archaeologist, historian, psychologist, five students, and myself the philosopher, our little group took the overnight ferry from the Peireus to Herakleion in Crete. The weather was rough and rainy on that April day when we set out together. As we waited to leave the Athenian port, we read aloud from Katsansakis's *Zorba*. I took special amusement at those passages in which the narrator sat in the cafe to wait out the stormy weather, just as we did. As we disembarked the ferry at daybreak the next morning, having sailed through rough seas, sure enough, just as in Katsansakis's tale, almost everyone smelled of vomit and cologne. My adventure had just begun.

In Crete, we first visited the Minoan palace at Knossos. The archaeologist quickly oriented the group to the site, the historian filled in relevant background, the psychologist reflected on various issues especially pertaining to religious rituals, and the rest of us joined in with questions and comments. The same routine was repeated in Phaistos. By the time we arrived in Malia, our third palace site, we were able to conjecture correctly the layout of the site without the preliminaries by our archaeologist, so excellently had we been prepared at Knossos and Phaistos. During the evenings, this diverse and eclectic group engaged in lively and far-ranging conversations, and some Greek dancing, while we shared delicious meals at the local *tavernas*. Thus, my idea for an unusual travel-study program was born, though first it was motivated principally as a way to educate myself further. After a few seasons of this labor of love, and with an ever-changing mix of academics, depending upon who was able and willing to join us—and whose families would allow them to slip away for a good part of a month, or longer—I found that I could take over the duties, however imperfectly, of the archaeologist or classicist, astronomer or mathematician, botanist or biologist, historian or political scientist, when someone or other could not join us. As the program developed, each year we proposed new itineraries to keep the faculty as excited as the new students. As a result, I have visited many, many places in Greece off the beaten path. I am explaining this program in some detail since its interdisciplinary character significantly affected my approach, and also because it provided the regular and continued opportunity to visit Greece, which proved indispensable to the writing of this book.

From the mid-1980s onward, a hands-on ingredient was added to our formula of interdisciplinary and team-taught projects, and my research into ancient technologies was advanced again. I owe the root of this idea to Rick Williams, a professor of Classics and Director of University Honors at Southern Illinois University, who orchestrated a lively and informal dramatic performance of an ancient play on one of the Greek islands. The experience was not only great fun but also reminded me how much deeper and long lasting the learning can be if we participate in the activities whose genesis and development we are tracing. The result was to institute a practice: henceforth, each professor would supervise one hands-on project of his/her own devising. The architect would organize the construction of a model of an ancient temple at a local potter's shop. The astronomer would direct the making of an ancient sundial or star map. The political scientist would recreate a debate or trial in an ancient law court. The philosopher or mathematician might bring us all down to the beach and work out some geometrical theorems in the sand. The classicist would direct the performance of an ancient play with costumes and masks we made ourselves. The anthropologist, marine biologist, botanist, and so on, would each orchestrate his/her exciting project. In these ways, the program, and my commitment to a genuinely interdisciplinary approach to ancient Greek thought, took shape by the mid-1980s.

I extended the project to include Egypt in order to broaden investigations into ancient Greek culture and sources of influence. The wonderfully preserved monuments in Egypt helped students and faculty alike to imagine better the great Greek monuments that were now in ruins. Our expeditions to Egypt assisted the group in comparing and contrasting two different cultures, contributed further to the development of multicultural sensitivities, and for my research, afforded me continuing opportunities to explore the transmission of culture from Egypt to Greece.

Over the last seventeen seasons, and thanks to generous support from then-Chancellor John Guyon of Southern Illinois University, throughout the 1990s I have been able to continue my visits to Greece and Egypt. As the readers will see, this book is a fruitful consequence of many visits. For unlike some of the approaches that are familiar in Presocratic studies, my research grew directly from spending time at the ancient sites, year after year, and wondering what it meant for Thales and Anaximander to live in Miletus, and most especially, in terms of the architectural projects on-going contemporaneously in Didyma, Ephesus, and Samos.

Along the way, other important opportunities helped me to develop my interdisciplinary approach. A series of grants from the National Endowment for the Humanities all promoted the breadth of my research. A summer Seminar grant in 1979 in Sanskrit and ancient Indian Science and Epistemology (Nyaya-Vaisheshika), directed by Jitendra Mohanty, then at the University of Oklahoma, urged me to broaden my vision of ancient Greek science and philosophy. A summer Seminar grant in the history of science in 1985, directed by Robert S. Westman, then of UCLA, forced me to think about "scientific revolutions" and, in turn, the social and political context in which ancient scientific practices unfolded. An NEH Individual research grant on ancient Greek technology and philosophy in the summer of 1987 was constructively followed by an NEH summer Seminar in Ancient Greek Religion in 1988 at Stanford University, directed by classicist Michael Jameson; Jameson's seminar helped me to focus on temple building and the sanctuary that was created for religious rituals and sacrifice. An NEH summer Institute grant in Science, Technology, and Society at Wesleyan University in 1991, directed by philosophers Steve Fuller and Joseph Rouse, encouraged me to investigate further "science as a cultural practice," the social and political context in which science and technology are produced. In 1992 an NEH summer Institute on Athenian Democracy at the University of California at Santa Cruz, directed by classicist Charles Hedrick and political scientist Peter Euben, invited me to reflect again on ancient political conditions and the possible influence they exercised on the development of philosophy and science. And in 1996, another grant enabled me to participate in an NEH summer Institute at the University of Arizona, New Perspectives on Classical Antiquity, directed by classicist Bella Zweig-Vivante; Zweig-Vivante's Institute offered me the chance to investigate again a wide range of possible influence that Egypt exercised on Hellenic culture. Thanks to the Seminars, Institutes, and Individual grants, sponsored by the National Endowment for the Humanities, and the directors and fine colleagues who kindly listened to me and discussed my thoughts, many of the ideas presented in this book were both advanced and refined.

This book developed over quite a number of years and, despite whatever shortcomings it has, was improved by virtue of various kinds of assistance and discussions. Graduate students Bill Eaton and Maria Snyder assisted me in valuable ways with my research, and Cynthia Jones provided the graphic art and formatting that has been indispensable to my presentation here. Recognition and thanks are also appreciatively extended to former Dean Dr. John Jackson and Acting Dean Dr. Robert Jensen, of the College of Liberal Arts at Southern Illinois University, whose support over the years, especially with sabbaticals, greatly aided my efforts. Valuable discussions at archaeological sites over a ten-year period with Nanno Marinatos helped me to get started on my project. I am especially grateful to Mark Johnson, who discussed many of the issues here and participated in at least five adventures to Greece and Egypt with me; his work continues to challenge me to work out the role that the imagination plays in the development of rationality. I am grateful for correspondences with G. E. R. Lloyd, who kindly read chapter 1 and helped me to understand his positions more clearly, and, in the process, my own. I am grateful to Sarantis Symeonoglou for his willingness to discuss my ideas and for helpful suggestions and encouragement over the last decade. I owe a special debt to my colleague Andrew Black, who cheerfully discussed many parts of the developing manuscript with me; many of the passages have been improved, and some of the arguments have been clarified, thanks to his willingness to read and comment upon my work. I am especially grateful to Gerard Naddaf and Dirk Couprie, with whom I have participated on conference panels, and whose writings and discussions on Anaximander provided much illumination for me over the last decade. But, most especially, my thanks go to Tony Preus, editor of the Ancient Philosophy Series for SUNY Press, whose support, encouragement, insights, suggestions, and above all, patience made it possible for this project to see the light of day.

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# *Introduction*

Anaximander is first and foremost a *transitional* thinker. The doxography credits him, appropriately, with "firsts"—the first philosophical book in prose, the first Greek map of the inhabited earth, the first Greek seasonal sundial, the first geometrically modelled map of the cosmos—but when we describe them as firsts, we tend to lose sight of their transitional character. What kind of transitions do these accomplishments represent? They represent transitions in the purpose and social use of prose writings, transitions in the articulation of geography for flourishing mercantile trade, transitions in the accuracy of measuring devices and specifically measurements to mark out the frame for the terrestrial map, and transitions in representing the present world cosmos and the preceding cosmogonical stages through which it was brought about. To see these firsts as transitions is to bring into focus the background against which these innovations acquire their original meaning.

Anaximander's cosmic cartography, for instance, deserves to be illuminated by contrast with pictures derivable from Homer and Hesiod in order for us to grasp both its originality and its very possibility. Homer's description of Hephaistos's crafting of Achilles' shield, the world-as-shield, built up in stages of construction, adumbrates Hesiod's cosmogonical stages and poetically inspired cosmic picture. While the symmetry of Homer's cosmos is displayed in uniform distances between Heaven and Earth, Hades and Tartarus, these cosmic distances are defined by Hesiod in terms of 9 + 1 anvil days, the time it would take a falling anvil to traverse each respective distance. In the cases of both Homer and Hesiod, poetic formulae, not observation and experiment, account for the reckoned proportions or numerical assignments. Now, while Anaximander's cosmology is also not based upon observation and experiment by means of adequate astronomical instruments or theories, it marks a transitional stage to them. In the succeeding centuries, observation and experiment would come to play a more pivotal role in astronomical theories, and cosmologies derivable from them. Anaximander's cosmology, however, represents a transition in which cosmic distances, still reckoned poetically and symbolically, are employed to save the phenomena or at least not to confound simple observation, when calling upon archaic formulae. The terrestrial map, unlike the cosmic map, is more amenable to testing. Seafarers and caravans, no doubt, provided the observations by which Anaximander's claims could be confirmed, corrected, and refined, as the later tradition of Ionian cartographers proves. The seasonal sundial offers an example of transitions even farther along to the scientific mentality evidenced in the classical period; its construction was clearly the result of observation and experiment, and testable without wandering far from home as was required to test his earthly map. Experimental science does not develop *ex nihilo*; Anaximander's thought deserves to be recognized as a lighthouse on the way toward it.

Anaximander was reaching out toward a structural explanation of the cosmos in an age that had only the vaguest conception of it. The invention of a seasonal sundial, however, leads the way in this transitional stage toward thinkers who would follow and who would progressively supply structural details, philosophers such as Empedocles, Anaxagoras, Democritus, Plato, and Aristotle, on the one hand, and astronomers such as Meton, Theodorus, Eudoxus, Callipus, Heraclides, Aristarchus, Archimedes, and Hipparchus on the other. Indeed, in the absence of any adequate astronomical theory or instruments, Anaximander *imagined* the shape of the earth, stars, moon, and sun, and their distances from us. But from where did he find exemplars of precision measurement and explanatory models that fuelled his imagination of a universe expressible in geometrical proportions and subject to law-like patterns? Of all the sources that have been investigated, one important source that has not been examined with sufficient clarity is craft knowledge, the exemplars from ship building, musical instruments, the blacksmith's and carpenter's shop, the stampers of coins, and most especially for our focus here, the architects undertaking monumental temple construction in the late seventh and early sixth centuries BCE in Ionia. Driven by rational rather than mythic constraints, Anaximander ventured out from a world steeped in mythopoiesis and began the march toward prosaic fact making, inspired by archaic exemplars that exhibited precise measurement and geometric proportions. His achievements are firsts so long as we understand this to place him in a social context from which he emerges as a transitional figure.

Cornford, Kahn, Vernant, Lloyd, and most recently Naddaf and Couprie, have shown in various ways how Anaximander integrated and transformed earlier traditions that he inherited. But the idea that the architects, building monumental temples contemporaneously in his own backyard, contributed significantly to his philosophical mentality, has never been seriously explored. The reason why the architects have been routinely passed over—and indeed the contributing role of *technē*, that is, technologies and craft knowledge—stems from the way that Greek philosophy, by and large, has been characterized following long traditions of interpreting Plato and Aristotle. These traditional interpretations have identified the rise of Greek philosophy with the triumph of the mind over the body and the senses. Since *technē* is inextricably linked to the body and senses, the rationality that is commonly identified with Greek philosophy appears to arise as a rejection, not an embracing of it. But it just so happens that Anaximander's philosophical mentality was nurtured by technologies in a way that has hardly been appreciated. Consequently, this new study seeks to promote a review of this traditional conception of rationality in the process of reappraising the origins of Greek philosophy. The rationality that characterizes Greek philosophy emerges from a complex embrace rather than a simple rejection of sense knowledge and know-how.

The complexity emerges when we follow the lead of technological innovation—the architects and their monumental temple projects—and explore the social and political context in which these extraordinary projects unfolded. Temple building brought together a wide range of interwoven themes, including new technologies, the expressions of religious symbolism, the social consolidation of the communities through regularity of worship, and the ascension of the polis over the ethnos by wresting authority away from the former tribal elders. Once one concedes that architectural technologies contributed significantly to Anaximander's philosophical conceptions, the new narrative of the origins of philosophy, partly traceable to him, must integrate the social and political complexities along with the flourishing, new technologies. The result is to see Anaximander's originality as marking transitions within archaic society. To accomplish these ends, this book is divided into five chapters: (one) Anaximander and the Origins of Philosophy; (two) The Ionian Philosophers and Architects; (three) The Techniques of the Ancient Architects; (four) Anaximander's Techniques; and (five) *Technology as Politics:* The Origins of Greek Philosophy in Its Sociopolitical Context.

Chapter 1 sets the stage for the reappraisal of philosophical origins. Unlike the studies in Greek philosophy shortly after the turn of the twentieth century that sought to account for its origins by appeal to the "Greek Miracle," numerous studies during the second half of this century attempted to account for Anaximander's innovations in terms of context and transition within the ancient world. But even among these studies, there are different approaches and assessments. In order to make sense of these disparities, a new classification is proposed in terms of three tiers. The so-called first tier brings together accounts that focus upon the systematic programs of Plato and Aristotle in order to identify the essential characteristics of philosophy. The so-called second tier brings together accounts that focus upon the sixth century and try to identify the "first philosophers" in terms of the rejection of myth and the proposal of rational explanations. The so-called third tier offers to account for the cultural context, traceable through the seventh and early sixth centuries, in terms of and against which Anaximander's innovations represent a meaningful departure.

When the three tiers have been distinguished, the important studies that try to explain how Anaximander's efforts should be seen in the context of continuity and transition are re-organized. Proponents of second-tier accounts such as Cornford, Vernant, Vidal-Naquet, Burkert, and West are contrasted with Lloyd's first-tier accounts. Since Lloyd has written so much on these themes over the past twenty years, his influential positions are outlined in the process of producing what we might regard as the "conventional view." The conventional view consists in five hypotheses that offer to account for the emergence and development of Greek philosophy, and the new thesis that is proposed here—*Technology as Politics*—overlaps two of these well-known hypotheses.

Anaximander's conception of the shape and size of the earth as a 3 × 1 column-drum is the point of departure in chapter 2. Rather than grasping the expression as a sort of throwaway, it is interpreted to point not only to the architects and their techniques but also to the religious and symbolic meaning that the column acquired for the ancient Greeks. When we fix the date of Anaximander's book, the first philosophical book in prose c. 548–547 BCE, we then try to understand the transitional role that his book played in archaic Greece. Seen against the context of prose writing in legal inscriptions and in the cosmology of Pherecydes, the *theologos*, Anaximander's book takes shape not only in terms of his importation of cosmic justice into our world but also as *phusiologos*, as nature-accounter. Whatever initial role prose writing assumed in the seventh century, Anaximander's book represents a transition in its meaning and use as the fifth and fourth centuries prove.

Against this background, we explore the only other contemporaneous group identified as producers of prose treatises: the architects. The case is made that the books of Theodorus, the architect of the archaic Samian Heraion, and Chersiphron/Metagenes, the architects of the archaic Artemision, served at least two purposes: they were practical guides to would-be temple builders springing up throughout Greece with the increasing wealth of their archaic communities; and in keeping with the agonistic spirit of Greek society, they were exemplars and celebrations of excellence for the creators of what their communities came to know as *thaumata*, "objects of wonder." The architects produced in their compatriots *thaumazein*, "wonder," the very experience with which Aristotle claimed philosophy began. Anaximander's book deserves to be seen in a comparable and competitive light.

Chapter 2 explores the community of shared interests that unites Thales and Anaximander, Theodorus and Rhoikos, Chersiphron and Metagenes and identifies the common thread as projects in *applied geometry*. It seeks to answer the question of who else in the archaic community of the *phusiologoi* was, besides writing prose treatises, engaged in measuring heights and distances, diverting rivers, and inventing technical devices to deliver precision measurements. The answer proposed is the Greek architects who, at the end of the seventh century and in the first quarter of the sixth century BCE began a project wholly new to Ionia, the building of stone temples of gigantic proportions. And with this undertaking came a host of new technical problems of quarrying, transporting, and installing huge blocks of stone, over and above the new problems of organizing large work forces unfamiliar with such technical projects, and securing continuing patronage that might be required for decades. The monumental building practiced by the architects deserves to be seen as formative stages of an experimental science. New innovations and techniques were required and their works offered their archaic communities exemplars in an enterprise for which a new relation between theory and practice could be tested. And not only that, but also by means of their experimentation, and their successes, a sprouting vision of nature subject to laws was given a foundation that all could witness. This new enterprise in trial and error was an intellectual adventure that readied the Ionians for discussion and speculation while it provided a community of interests and objects of reflection for the newly emerging *phusiologoi*. But from where did the Greek architects get their inspiration and know-how to build multicolumned stone temples of gigantic proportions? The most plausible answer is Egypt, and chapter 2 offers to explain how that acquisition came about. In so doing, the argument is made that the Greek architects themselves should be seen as transitional figures, for while they relied on Egyptian influence and techniques, they produced temples of a unique and original type.

While chapter 2 investigates the contemporary communities of the *architektones* and *phusiologoi*, chapter 3 focuses on specific architectural techniques that the Greek architects imported. The techniques include (1) imagining in plan or aerial view, (2) model making, (3) the theory of proportions, and (4) *anathyrōsis* and *empolion* on column-drums. First of all, it was routine for the architects to imagine their monumental buildings from a plan or aerial view prior to and throughout the construction process, and it now seems likely that they made drawings prior to their building, but apparently not drawings to scale. Second, we have significant evidence for model building connected to architectural technologies. Third, there is a general consensus concerning the Greek architects that, in the absence of scale-drawings and scale-models, they apparently relied heavily on a design technique that we have come to call the "theory of proportions." And fourth, when column-drums replaced single-stone columns as the monumentality increased, and faced with a new problem of how to dress each drum so that it would interface exactly with the next drum or base, the architects made use of a technique, with a long history in Egypt, which we now call *anathyrōsis.* In the Greek construction, the *anathyrōsis* preparation, together with the device known as the *empolion*, assured a perfect fit in column construction. We examine the evidence for *these* techniques because it is plausible that they contributed to Anaximander's philosophical imagination.

Chapter 4 follows directly. Since the case to be made is that Anaximander's column-drum earth is no throwaway but rather hints at architectural influence, we turn to examine Anaximander's own techniques to see how plan views and three-dimensional views, model-making techniques, the theory of proportions, and *anathyrōsis* and *empolion* illuminate his achievements. That Anaximander imagined in terms of a plan view is proven by the attribution that he was the first Greek to make a map of the *oikumene*, the inhabited earth. The map, perhaps made on a wooden tablet or worked in bronze, must have been a plan or aerial view, just like the construction of the world-as-shield expressed in Homer's *Iliad*. In order to make a terrestrial map, Anaximander had to mark out an earthly frame. To do so, Anaximander invented a *seasonal* sundial by which he could identify unmistakably the points on the horizon corresponding to the risings and settings of the sun on the summer and winter solstices, and perhaps the equinoxes. Anaximander is also credited with the first geometrically modelled map of the cosmos, and when we try to reconstruct it in a drawing, we are challenged to wonder from what perspective we should do so. From what perspective(s) did Anaximander imagine the cosmos? The clue to this new avenue of investigation comes by way of the architectural techniques we investigated in chapter 3. Now, our examination of archaic column-drums and the *anathyrōsis* and *empolion* techniques visible upon the drum faces, together with the design technique called the theory of proportions, are brought to bear on Anaximander's cosmic imagination. As we revisit them in this architectural illumination, the new third tier begins to open further to view, the cultural context in which Anaximander flourished. For no one should underestimate the dramatic effect that such huge buildings would have had on the archaic audience, certainly in the absence of any comparable predecessors in eastern Greece. These colossi not only produced an overwhelming visceral impact but also readied Anaximander's community to hear cosmic speculations that relied on architectural designs and techniques, since the temples themselves offered abstract expressions of cosmic power. In Anaximander's selection of the column-drum we overhear, as it were, ancient discussions about the cosmic and symbolic meaning of the column in particular and the temple in general.

The column-drum had symbolic meaning but it also had a technological meaning. It was an architectural innovation, likely imported from Egypt, in answer to the challenge of delivering weighty and unwieldy monoliths the many kilometers from the quarry to the building site. While the quarrying of the much smaller drum blocks solved the difficulty of transport, it created a new technical problem in installation. How could the architect assure both the lateral and vertical fixity of the drums as they were placed one atop another and yet successfully carry the enormous weight of the entablature above? This was just the kind of problem that absorbed Anaximander in explaining why and how the heavy column-drum earth achieved lateral and vertical fixity, remaining motionless in the center of the cosmos. In chapter 4, Anaximander's plan view of the cosmos is reconstructed and the reader will see that it bears too striking a similarity to the prepared drum face to be passed off as mere coincidence. The influence of the architectural production is obvious and it hints further at the symbolic and cosmic significance of the column. For Homer and Hesiod, the column separated heaven from earth, for Pindar the column connected heaven and earth, and for the Pythagorean teller of the transmigratory Myth of Er in Plato's *Republic*, the column ran through the whole cosmos as its central axis. Anaximander fits into this tradition, for he imagined the earth to be a 3 × 1 column-drum, and the whole universe constructed in column-drum proportions. This is precisely an application of the architect's rule of proportion, not to terrestrial architecture, but rather to cosmic architecture. In this sense, Anaximander emerges as a kind of architectural historian of the built cosmos. Not giving instructions to would-be builders, as did the Ionian architects in their prose treatises that almost certainly gave the rules of proportion, Anaximander sought to explain in his prose book the structure, sequence, and rules of proportion by which the cosmos was constructed. In chapter 4 it is argued that in his picture of the cosmos, the heavenly wheels of the sun, moon, and stars form the rings of a cosmic tree analogous to the sacred trees that were replaced by stone columns when the temples became monumental.

The case for the central cylindrical, not spherical, form is made more clearly, however, when we turn to consider further Anaximander's cosmos, this time in three-dimensional views and orthographic projections other than plan. The seasonal sundial made it unambiguously clear that the sun ring appeared higher in the heaven during summer and lower during winter, and so Anaximander realized that the picture of the cosmos would appear differently, like the temple, when imagined vertically and obliquely rather than in plan view alone. Just as the emerging patterns appear structurally different when contrasting the temple in plan from side, elevation, oblique and axonometric views, so also for Anaximander's cosmos. When the plan view is projected orthographically, the result is a cylindrical, not spherical, frame. The heavenly "bodies" are holes in the three fiery wheels Anaximander identifies, and commentators have routinely followed the ring imagery to come to the conclusion that Anaximander's cosmos is ultimately spherical. However, when we try to picture the "sun" *vertically and obliquely*, a ring full of fire encased in mist, sliding up and down through the changing seasons *without changing its angle of inclination to the plane of the earth*, the cylindrical, not spherical, structure pops out. Orthographic views other than plan are reconstructed after reviewing other scholarly attempts to picture Anaximander's cosmos and the shortcomings of these earlier efforts are identified. The result is a new grasp of the cylindrical imagery that follows from the special debt that Anaximander owes to the architects. The argument is not that Anaximander simply copied the architects any more than the architects simply copied one another, but rather that his philosophical imagination drew upon architectural techniques. And Anaximander's intended audience would have grasped the analogy unmistakably.

While chapter 4 defends the substantive claim of architectural influence, that Anaximander imagined the house that is the cosmos from more than one view, just as the architects routinely imagined their cosmic and divine house, chapter 5 tries to reconstruct the new sociopolitical story of the origins of Greek philosophy. If Anaximander's philosophical mentality was influenced significantly by the architects, then one part of the untold story of the origins of Greek philosophy is that it emerged from, and was embedded within, the social and political complexities that motivated temple building. For the first time in archaic Ionia, the Greeks built monumental temples to Apollo in Didyma, Artemis in Ephesus, and Hera in Samos. In chapter 5 we ask: Why were the Greeks building monumental stone temples? Who paid for them? What did the patrons believe they were getting for their enormous expenditure? In the last decade, a new interdisciplinary avenue of investigation into science has been paved by studies about experiments, by looking into the social and political context of those enterprises. In this approach, chapter 5 offers a case study along the lines recommended by the proponents of Science, Technology, and Society [STS], who envision science as a cultural practice. It joins them in asking about experiments and the so-called objectivity of science: Who paid for them? Who owns the equipment? Who gets to use the results?

The final chapter turns to reconstruct, not the architecture nor the cosmic picture, but rather, an untold narrative of social and political transitions in the context of which Greek philosophy dawns. This tale of the emergence of philosophy from the Milesian efforts is a new aspect of the story of archaic transitions, of new innovations that arose as a direct consequence of social and political upheaval. With the bursting growth in population on the Greek mainland in the eighth and seventh centuries BCE, colonization was a strategy adopted when arable land became increasingly scarce and citizenship became ever more closely tied to land ownership. The building of temples was part of a social strategy to integrate the divergent groups that populated the new colonies, such as Miletus, with the regularity of worship. The temple was also instrumental in establishing the authority of the wider polis over its citizenry by wresting it away from the traditional tribal elders who presided in the ethnos, or tribal system, that had already been in place for hundreds of years since the fall of the Mycenaean central-palace system. One consideration, however, that has not been sufficiently addressed in the scholarly literature is the ethos that was projected by the temples to Apollo, Hera, and Artemis. In book 18 of the *Odyssey*, Homer has aristocratic Odysseus tell that ethos, which might be called the hymn to human incapacity. "Of all the creatures that breathe and walk on the earth there is none more helpless than a man." And furthermore, in a world of chaos and confusion, the best advice for mortals is simply to accept their situation, "to take in silence the gifts of the gods, whatever they give him." The mentality projected by the archaic aristocrats was that there is no underlying order to nature, or even if there is, mortals cannot come to know it. In the presence of the god—Apollo, Hera, Artemis—mortal wisdom is next to worthless, and the advice to the masses is to suffer in silence, for no man knows when bad shall become worse, when modest fortune may turn to dire misfortune. The building of temples to these deities, then, were monuments to the preservation of the status quo which could be nothing other than aristocratic advantage.

In the archaic period it seems likely that the temples were financed principally by aristocrats or aristocratic families. In the classical period, the Athenians, for instance, resisted this sort of aristocratic patronage for building projects because they came to see the unfair advantage the aristocrats sought through their patronage: the right to appropriate civic authority. To clarify this case, we turn to consider what might be called the *genealogical* or *inheritance* model of *aretē*. While Plato's dialogues reject the idea that excellence is something inherited, transferred by high birth from father to son, the rejection only makes sense in the context in which this idea had long been embraced. The aristocrats, by patronizing the building projects, sought to claim a right to control land and civic authority by appeal to a special connection to the deities at a time when challenges to aristocratic authority and land ownership were increasing, not only from neighboring factions but also from their own townspeople.

The archaic invention of the hoplite, the heavily armed foot soldier, was a splendid example of aristocratic efforts to bolster a failing authority. While, on the one hand, heavily arming their own townspeople, the aristocrats succeeded in fighting off neighboring insurgents who sought to contest the right of the local inhabitants to their land, on the other hand, during a year of drought, some fifty or sixty war-hardened aristocrats, with food provisions inside their fortification, found themselves with a thousand of their heavily armed townspeople banging furiously at their doors. The consequence, whether unanticipated or at least not fully foreseen, was a progressive loss of certain aristocratic prerogatives along with growing egalitarianism and democratic reforms.

The archaic invention of the temple yields an analogous tale. The archaic aristocrats paid the architects to come to center stage and build monuments to preserve the status quo, monuments to human incapacity. But, in the process, the architects and their communities progressively came to a vision that nature had an exquisite order and that mortals could come to discover, and even manipulate and control its law-like patterns by means of *technē*. The result was that the trial-and-error practices of the architects, by affirming an unforeseen or unarticulated human capacity, progressively undermined the very ethos that motivated monumental temple building in the first place. Just as the range of traditional aristocratic authority was diminished by creating the hoplite, so also, in a manner that was perhaps largely unforeseen, was it diminished by patronizing monumental temple building. This is not to say that the aristocrats did not retain advantage, for indeed they did, but the sphere of influence that they customarily enjoyed, along with its prerogatives, was diminished significantly as they sought to sponsor efforts to bolster a failing authority. The creation of the hoplite and the monumental temples in Ionia are both transitional episodes; they mark, in ways that their aristocratic sponsors perhaps could not have fully envisioned and likely did not fully intend, the flourishing of egalitarian and democratic reforms along with the diminution of their own traditional authority.

Thus, while on the authority of Aristotle, Thales and Anaximander are part of the earliest horizon of "philosophers," and among the originators of the new social role with its peculiar inquiries, such a view emphasizes how they are to be distinguished from their predecessors rather than how they follow from them. This familiar view is not inappropriate but the study here seeks instead to locate Anaximander, and Thales, in the cultural context from which their innovations emerge. What makes this study different from many others that have focused on the Milesians is its focus on their transitional role. What we come to see by means of this approach is the emergence of philosophical thought, of a rational and prosaic presentation, against a background of ongoing activities in which their enterprises are embedded—technological, religious, social, political—and hence the reaffirmation of a model of continuity and transition instead of the once fashionable "Greek Miracle" to account for the origins of Greek philosophy.

By focusing upon their transitional character this study might be supposed to diminish the Milesian originality, but this would not be so. What is required, instead, is a clearer perception that the very meaning of "originality" must be re-connected with "transition" and "continuity" because new ideas and new social roles do not emerge *ex nihilo* but rather against a background of converging activities and interests. Anaximander's terrestrial map, his invention of a seasonal sundial, and his geometrical model of the cosmos are bold new innovations to be sure, but they have a meaning, and indeed can only be properly understood, when seen against a context of earlier efforts in imagining the shape and size of the *terra cognita*, in images depicting time reckoning by means of shadow clocks, and in images projected by means of poetic expressions of cosmogony and cosmic cartography adumbrated by Homer and Hesiod. The originality of Anaximander and Thales, as perhaps the first philosophers, must be seen from the springboards of ongoing activities—especially technologies—and accepted social roles from which their transition is effected.

# 1

# *Anaximander and the Origins of Greek Philosophy*

## The Problem and the Three Tiers of Explanation

How shall we account for the origins of Greek philosophy? To answer the question requires, first of all, that we determine precisely what we are trying to explain. This, of course, proves to be a daunting task for it is in large measure a perennial problem for philosophers: What exactly is philosophy, and what did it mean to the ancient Greeks? We can profitably distinguish two kinds of questions in our inquiries:

(A) What are the defining characteristics of Greek philosophy in terms of which we can distinguish it from earlier pre-philosophical thought?

(B) What explains the rise of this particular type of thinking in Greece?

Naturally, the answer we give to (A) will affect the way we approach (B). Reflecting upon the diverse scholarly literature over the course of the last century, the disparate views and approaches suggest, not surprisingly, that there is considerable disagreement about precisely what "Greek philosophy" denotes and connotes. When the variety of opinions have been assembled, however, they may be roughly but usefully classified into two groups. On the one hand, we have what might be called first-tier accounts. These accounts answer (A) by identifying epistemological and ontological concerns in the systematic programs of Plato and Aristotle as characteristic of philosophical thought. First-tier approaches offer historical narratives that tend to look backward in time, before the classical period, to determine who should and who should not be included in the story that leads up to them. On the other hand, we have what might be called second-tier accounts that see the rationalizing activity of the Presocratics as characteristic of philosophical thought. Second-tier approaches offer historical narratives that focus upon the rejection of mythopoetical explanations and the adoption of *rational* explanations (*logon didonai)*, usually in prose, in attempting to explain the causes of this mentality. The use of this parlance, first tier and second tier, then, is a way of approaching the question about just what needs to be explained. First-tier proponents identify the epistemological and ontological concerns articulated by Plato and Aristotle, as central to "Greek philosophy," and the historical narratives include those earlier figures who supply and promote those characteristics. In first-tier accounts, the Milesian philosophers tend to become marginalized. Second-tier advocates identify the rationalizing mentality that dispenses with mythopoiesis as characteristic and central to identify the emergence of philosophical thought, and these historical narratives tend to focus upon the archaic thinkers of the sixth century BCE, Thales and Anaximander in particular.

Anaximander of Miletus, the *phusiologos*, has not always been judged to be a *philosophos*.[1] But, when doubts are raised about his place in the historical narrative, they almost always come from proponents of first-tier approaches. In contrast, Anaximander is invariably included as a philosopher by those who adopt second-tier approaches. The general case to be made here is that Anaximander deserves to be included as a philosopher by either approach. This is because in order for us to understand what philosophy meant to the ancient Greeks we must come to grasp the newly emerging philosophical enterprise in terms of gradual transitions, rooted in archaic society, and yet distinguishable from those such as Homer and Hesiod. The ascension of reason, the promotion of rational over mythic discourse, is the cornerstone for making the case on behalf of Anaximander, even in terms of the promotion of epistemological and ontological concerns.

In order to grasp more clearly, however, about *what* and *how* yet needs to be explained about the origins of Greek philosophy, this study aims to open what we can call a third tier. What is this "third tier"? This third tier offers a new kind of explanatory hypothesis, and thus is suitably distinguished from the second tier. While second tier proponents tend to identify the incipience of philosophy with Milesian rationalizing activities, freed from their mythological moorings, they sought to illuminate the context in which these innovations transpired. What they did not supply was an explanation of precisely what fuelled the rationalizing. As we shall see, the architects, and their monumental projects that dazzled and transfixed archaic communities, powerfully supplied exemplars of a rationalizing mentality. When this new avenue of explanation is opened, the third tier is shown also to consist in the social and political context of the seventh and sixth centuries BCE, in terms of which, and against which, Anaximander's innovations represent a meaningful departure. The new and previously unexplored aspect of the third tier that we shall investigate, then, is the Ionian architects and their monumental building projects, and the social and political complex that brought them to center stage in archaic Greece. And if we see that philosophy emerged gradually, then, properly understood, the systematic programs of Plato and Aristotle depend upon an appreciation of a wide range of contributing factors including those of Anaximander. This, however, requires, in turn, that we get clearer about the factors that promoted Anaximander's *rationalizing* mentality. Thus, while it seems certain that Anaximander made a variety of original contributions each of which exhibits a rational character including the writing of a book, arguably the first "philosophical" book in prose, his originality is best illuminated in terms of the transitions that he heralded within the fabric of archaic Greek society.

This approach of grasping philosophy in terms of gradual transitions had not always been favored. Indeed, in the early part of the twentieth century, estimable scholars with wide influence such as Burnet and Heath sought to account for the origins of philosophy by appeal to the "Greek Miracle." In 1914, Burnet offered to account for the Greek achievement by insisting that "they were born observers."[2] Heath, in his magisterial work of 1921, claimed that the success of the Greeks was due to their being "a natural race of thinkers."[3] Even as recently as 1962, a scholar such as Fränkel was still able to suggest that "pure philosophy . . . came into existence suddenly and without a cause . . . as if by a miracle. . . ."[4] The turn away from "miraculous" accounting and toward explanations that sought to preserve continuity and transition was led by the influential Cornford,[5] and was followed, by those such as Vernant,[6] Burkert,[7] West,[8] and Lloyd,[9] whose approaches have now become dominant. While these scholars share an interest in explaining the originality of Greek philosophy in the context of ancient culture, Cornford, Vernant, Burkert, and West belong to the second tier for they have focused on *how* Anaximander rationalizes mythic traditions, how he untethers himself from anthropomorphic moorings and instead gives a rational account *(logon didonai)*.[10] Lloyd, in contradistinction as we shall see, is a first-tier proponent and seems ambivalent about the place of Anaximander. For, on the one hand, Anaximander falls short of fulfilling the conditions of promoting second-order questions and rigorous proof that ultimately, for Lloyd, characterize "Greek philosophy"; while, on the other hand, Lloyd, too, sees Anaximander as part of the background narrative that leads to Plato and Aristotle. But, whichever tier we prescribe as our starting point, embracing a vision of the emergence and development of Greek philosophy as a *gradual* process still leaves unanswered the questions about just which factors plausibly contributed, and which individuals deserve to be included, in the historical narrative. Does Anaximander deserve to be included, and if so, why?

Cornford, Vernant, Burkert, and West all offer second-tier approaches, and each sought to explain aspects of archaic culture that plausibly informed Anaximander's mentality. In answer to (B), each scholar sought to explain the relevant factors that produced Anaximander's demythologizing mentality, and so contributed to the rise of Greek philosophy. Cornford traced the roots of Anaximander's cosmology to the Babylonian myth, the *Enuma Elish*, the creation of the world by Marduk, by way of Hesiod's *Theogony*.[11] He envisaged Anaximander's philosophical originality in the context of transitions within archaic society and in terms of narrative stories about origins. Anaximander, on Cornford's account, had not merely rationalized the cosmos but moreover had rationalized Hesiod's mythical account. Thus, an understanding of Hesiod, where Zeus replaced Marduk, became the essential context for an understanding of Anaximander's originality; Hesiod's originality, in turn, required a grasp of the Babylonian creation stories. Our grasp of originality, not *ex nihilo*, required that we see innovation in the context of transition.

Vernant took up Cornford's exegesis and carried it farther.[12] Against the background that Cornford had illuminated, Vernant invited us to see Anaximander's new geometry of the cosmos as a reflection of changing political ideas and the social reorganization that came with it. The tripartite division in the reformed Greek society was echoed, or adumbrated, by Anaximander's cosmos, divided also into three heavenly regions. Burkert sought to explain Anaximander's heavenly order, untypical of the Greek meteorological tradition, by appeal to the Avestan texts sacred to the Zoroastrians.[13] The placing of the stars closer to us than either the moon or sun seemed strange only if we did not know that this order was explicitly articulated in the texts that outline the movements of the great divinity Ahura Mazdah, who travels to the sun, then the moon, and then the stars, before finally arriving at the hearth in the home. And West followed Burkert's lead in tracing Anaximander's originality to a new integration of Persian religion with the tradition of Greek meteorology. To think that the Zoroastrian ideology that pervades Anaximander's thought chanced to burgeon in his mind coincidentally at the very time when the *magoi* had been dispersed from Persepolis and Ninevah and wandered down the west coast of Asia Minor would be, West regarded, as preposterous as it was pointless.[14] Thus, unlike the appeal to the "Greek Miracle," the influential work by Cornford, Vernant, Burkert, and West offered a range of accounts that sought to explain Anaximander's originality—his emerging rationality—in the context of archaic Greek culture. And their important second-tier studies have inspired many others to follow their methodological lead. But, while each of these important scholars tried to reveal a context that illuminates Anaximander's projects, what they did not supply was an explanation of what motivated his *rationalizing* narrative. This explanation of Anaximander's rational techniques is the business of the new third tier.

We may regard the "conventional view" of the origins of Greek philosophy to consist in five hypotheses, each one of which has been claimed to offer a necessary and/or sufficient condition to account for its emergence: (1) leisure, (2) intermingling of beliefs, (3) literacy, (4) technology, and (5) the polis. Each hypothesis has been defended in some form or other, and an appeal to these hypotheses can be employed by proponents of either the first or second tier. G. E. R. Lloyd, whose work belongs broadly to what we are calling the first tier, discussed but rejected the first four hypotheses that comprise this so-called conventional view. His extensive work, visiting and revisiting the theme of the origins of ancient philosophy, shows how he sought to refine and modify what he seems to have regarded as the most promising of the hypotheses—the polis hypothesis—over the course of the last two decades. We now turn to this discussion to get clearer on the conventional view and its shortcomings.

## The Conventional View and Its Discontents

The conventional view is a way of discussing the various explanatory hypotheses that have been proposed to account for the emergence of Greek philosophy. First-tier proponents, such as Lloyd, challenged the first four hypotheses in the process of trying to defend a first-tier approach. He did so by showing why the conventional view failed to provide a sufficient condition, and to that view he added a fifth hypothesis, broadly political in nature, to remedy the defect. Lloyd's work over the last two decades continued to struggle with and modify his sequence of deliberations. After examining Lloyd's case, exemplary of first-tier proponents, second-tier objections to the first-tier approach will be considered. Next, a review of the progress of Lloyd's case illustrates how first-tier approaches may be further defended. Finally, a response is in order to show why Anaximander deserves to be considered a philosopher from either approach.

Lloyd's insistence on a first-tier answer to (A), the question about what the defining characteristics of Greek philosophy are, leads him in (B), the explanations of the rise of this kind of thinking, to focus upon political causes, and ultimately political "correlations" to the detriment of other features of the conventional view—notably technology; his failure to take Anaximander seriously as part of the philosophical tradition, placing him instead in the background, leads him to overlook the significant fact of the interplay between politics and technology. To see how this first-tier defense can be orchestrated, we turn to his work as an exemplar of this approach.

Lloyd's work on the origins of Greek philosophy spans more than three decades. From 1979 through 1996, he has directly addressed the central problems under investigation here, and has also modified his positions over the years.[15] In Lloyd's more recent studies, where epistemology and ontology are called upon to identify "philosophy" proper, Anaximander's inclusion among the "philosophers" became difficult to defend, since Lloyd became convinced that so little can be deduced from the secure evidence for him. Like the second-tier proponents, however, Lloyd also has attempted to account for the gradual emergence of Greek philosophy, and like some of them, he has emphasized political and legal factors. But, Lloyd's orientation is first tier; he focuses upon the kinds of epistemological and ontological inquiries that flourish in Plato and Aristotle, and then working backward, as it were, judges who does or does not address these explananda, or whether or not there is reliable evidence to decide the issue. Consequently, Anaximander retains at best an ambiguous status since he assumes a place in the background, not the foreground, of the discussion. Moreover, despite the extraordinary depth of Lloyd's learning, the early influence of the architects seems completely to have escaped his notice. To see this we would do well to retrace his arguments and their insightful modifications.

In *Magic, Reason, and Experience* (1979), Lloyd tried to account for the origins of Greek philosophy in the context of competing hypotheses already discussed in the scholarly literature. In order to appreciate what the hypotheses were attempting to illuminate, Lloyd, then, concluded that the essential explananda of "Greek philosophy" were: (1) *Rigorous Proof*, and thus rigorous demonstration;[16] and (2) *Self-Conscious Methodologies and Second-Order Questioning*. According to Lloyd, the development of self-conscious methodologies made prominent second-order questions about the nature of the inquiry itself. In contrast with Eastern predecessors, "the investigations only acquire self-conscious methodologies for the first time with the Greeks."[17] These conditions, as we shall see, Lloyd embraced more or less throughout the next two decades. And the readers can see immediately why, given these conditions, the inclusion of Anaximander as a philosopher is problematic. Lloyd explored four hypotheses—leisure, intermingling of beliefs, literacy, and technology—that sought to account for the gradual emergence of this new enterprise, each of which he regarded as at best necessary but in no way sufficient, before turning to focus upon the political hypothesis that he began to champion.

(1) *Leisure*: Aristotle supposed that the availability of leisure made possible by the wealth of economic surplus is a sufficient condition for the development of speculative thinking.[18]

(2) *Intermingling of Beliefs*: The sharing of different ideologies in the interactions with different peoples leads to a toleration for differing points of view and an openness in thought for one's own traditional beliefs.[19]

(3) *Literacy*: Written records provide a sufficient condition to account for this distinct kind of critical evaluation."[20]

(4) *Technology*: Technological mastery is a sufficient condition for the development of critical inquiry.[21]

Lloyd pointed out that these conditions were all present, even if in differing forms, in other Near Eastern civilizations. The Egyptians, Babylonians, and other Mesopotamian civilizations all possessed a leisured class, thrived in cosmopolitan cities where the interchange of differing beliefs must have been great, had literacy (in scribal-form connected not to public literacy but to the record keeping of the central palace), and far surpassed the achievement of Greek technologies, but on Lloyd's account not one of them apparently developed a tradition of the self-reflective and critical self-consciousness that characterizes the emergence of philosophy and science for the Greeks.

In Lloyd's 1979 estimation, the four hypotheses were suggested to have played some significant contributing roles but would not sufficiently account for these central characteristics in the development of rigorous proof and self-conscious methodologies. In addition to those hypotheses, Lloyd offered a fifth, broadly sociopolitical in nature, that he believed more adequately accounted for this unique transformation.[22] By doing so, he echoed the views already promulgated by Gernet,[23] Vernant,[24] Vidal-Naquet,[25] Detienne,[26] Vlastos,[27] and others that "Greek rationality is the product of the city-state." We shall regard these combined five hypotheses, together, as the *Conventional View*.

(5) *Polis*: The radical revision of the "framework of political relations" and of "beliefs about natural phenomena and the world" emerged co-relatively; developments in the legal and political domain provided images and analogies by which the spheres of law and justice could provide important models for thinking about cosmic order.[28]

Lloyd's view in the 1979 work, then, was that the growth of scientific inquiry and speculative thinking was a symptomatic expression of the dawning self-consciousness in other social and political domains. The development of the polis not only underlined the importance of freedom and free speech but also made possible "radical innovation," the "openness of access to the forum of debate," extolled the "habit of scrutiny," and fostered the "expectation of justification—of giving an account—and the premium set on rational methods for doing so."[29] According to Lloyd, the dawning of the philosophical and scientific spirit, expressed in these relevant factors, mirrored these sociopolitical developments. Consequently, the operations of the polis offered new models from the political and legal domains that suggested "the whole-world is a cosmos, that natural phenomena are regular and subject to orderly determinate sequences of causes and effects."[30] Those models provided a context against which one might investigate the broad range of natural phenomena.

But Lloyd's 1979 position was open to a variety of criticisms and the consequence was to urge him to modify his position. He never abandoned the centrality of the political hypothesis but the series of studies he produced testifies progressively to the acknowledgment that he could not provide the rigorous demonstration of political and legal causation that he himself initially suspected. Moreover, the overall balance of contributing factors also needed modification.

What was central to the conventional view, articulated by Lloyd in 1979, was the pivotal role that the polis played, especially in its promotion of democratic and egalitarian reforms, in stimulating and shaping philosophical activity. Hurwit and

Frischer, who represent second-tier approaches, both questioned the centrality of the these aspects of the polis in the earliest "philosophizing" of the Milesians. For whatever its plausibility may be for illuminating the nature of philosophical and scientific inquiry by the classical period, Lloyd's 1979 view, in their estimations, will not do for the opening activities of Thales and Anaximander in archaic Miletus.[31] Lloyd's argument, that participatory government promoted the origins of Greek philosophy, is hard to square with the political environment in archaic Miletus. Around 600 BCE and under the threat of Lydian aggression the tyrant Thrasyboulos ruled Miletus.[32] Whether he came to power as a result of the twelve-year siege of their city at the hands of the Lydian King Alyattes is hard to say. But that he was able to retain power in order to meet the emergency is less open to doubt.[33] Thrasyboulos is remembered by Herodotus as offering the wisdom to Periander, tyrant of Corinth, to kill the citizens who stood out from the rest as one might cut off the tallest ears of corn growing in a field.[34] So much for an openness to participatory government, disagreement, and dissent. However unclear the details of historical developments in the first half of the sixth century in Miletus, what is clear, according to Hurwit, is the general disorder, brutality, and instability of the social order. The pressures from both Lydia and Persia must have been great. As Herodotus informs us, Miletus was sacked again and again.[35] The picture painted by Athenaios is equally devastating; the poor trampled the children of the rich while the rich burned the children of the poor.[36] Few other cities were so ravaged, so unstable, and so apparently lacking in participatory government so central to Lloyd's defense of the conventional view.[37] And yet it is here in Miletus, following Hurwit's second-tier defense, that the origins are customarily traced. Moreover, the argument that participatory government was central to the initial stages of the innovations of Thales and Anaximander could not find much support from the political realities of archaic Miletus.

The likelihood, then, that the legal and political models of the democratizing polis directly stimulated Thales and Anaximander is difficult to accept. The extensive travels alleged of Thales placing him in Egypt, Babylon, and elsewhere, were to localities where central palace civilization flourished, that is, systems that do not readily come to mind when one looks for exemplars of participatory government. This does not mean, however, that Thales and Anaximander were unaware of legal and political developments on the mainland and the islands, and certainly such developments could have informed a background against which, for example, Anaximander's assessment of justice in nature might have taken shape.[38] But the point that participatory government directly nurtured Milesian innovations is a difficult thesis to defend. It is clear, however, that the conditions, whatever precisely they were, that nurtured Thales and Anaximander did indeed make it possible for them to open a new horizon of inquiry, one that challenged and inspired others in their Ionic communities to respond and expand, indeed competitively.

Frischer also challenged Lloyd's thesis by a different argument. First, he objected to Lloyd's 1979 view that as he saw it maintained that "Philosophy . . . is purely parasitical on society; it has no function to perform within the social system generating it except for imitation and reflection."[39] In this way, he was reacting to Lloyd's position that philosophical and scientific inquiry is merely a symptom or mirror of sociopolitical transformation. Frischer's constructive response was to ask us to consider the political ramifications of a naturalistic explanation of the universe in which mythopoetic devices are not included. The efforts by Thales, in his estimation, might be plausibly supposed to legitimate the foundation for tyranny by undermining the gods, heroes, and values of the aristocracy. "Thales' social role," according to Frischer, "was to provide Thrasyboulos with the same kind of cultural legitimacy that the poets had given to the aristocrats."[40] Thus, Frischer challenged us to think again about the specific sociopolitical context from which the Milesian innovations emerge; Lloyd's polis thesis, taken as a first-tier approach, is insufficient to illuminate these earliest chapters.

Hurwit, sympathetic to Frischer, proposed a variation of his own, but again in criticism of Lloyd's thesis.[41] For him, the origins of philosophy are not so much the efforts to undermine traditional aristocracy, nor the establishment of an acceptable foundation for tyranny. Philosophy begins in Miletus, on Hurwit's account, as an escape from the ravages the Milesians were forced to endure. The picture of Miletus that he sees is one in which the ruthless tyrant Thrasyboulos is replaced by ruthless tyrants who briefly succeeded him. Those episodes at the beginning of sixth-century Miletus were followed by two generations of class war and massacres of innocents. So, Hurwit is taken by the paradox that philosophy and the scientific spirit emerge against a backdrop of extraordinary chaos and brutality. He came to the interesting conclusion that "[t]he decisive factor in the birth of philosophy was not the need to legitimize tyranny but the need to escape it and the bloody sacrifice left in its wake."[42] Thus, for Hurwit, the emergence of philosophy was a reaction to chaos, not participatory government; it consisted in an effort to find stability and meaning in a world that seems to be robbed of it.

Both Hurwit and Frischer raised important points that contributed positively to the discussion, but their arguments, too, have problems. Hurwit's critique rested on the premise that Miletus was a complete disaster area, incapable of providing stability and torn by violent excess. To Hurwit's criticisms it may be objected that in the time of Lydian Alyattes' long rule, roughly 610–560 BCE, the Milesians unlike the defeated Smyrnans succeeded in making a treaty.[43] Since the whole region was broadly under Lydian control until the incursion of King Kroisos *circa* 560, the arguments about radical instability seem to be overstated. Indeed, the most recent excavations of the temple to Apollo Didymaios has revealed that a limestone and poros construction began, on monumental scale, perhaps as early as the late seventh century BCE and continued throughout the sixth century;[44] this certainly suggests that Miletus could not have been in the persistent degree of turmoil Hurwit claims. Although Hurwit's assessment of the first half of sixth century Miletus seems too strong, it does seem likely, however, that the innovations of Thales and Anaximander deserve to be seen against an unsettled background replete with injustice and in which participatory government was hardly the order of the day.

Frischer's critique reminded us that if we read the conventional view to maintain that philosophical and religious beliefs develop merely as imitation and reflection of some other aspect of society, however partly true it may be, then it is inadequate alone to account for the perplexities and the solutions that human meaning makers propose. The origins of Greek philosophy share with the prevailing archaic religion and its cult practices—with its prominent sacrifice and prayer—an attempt to understand the world and ourselves. To reduce philosophy, and religion, to a purely parasitical role on society is inadequate, and if the conventional view does so then it has left out an important ingredient of human soul searching and sources that provoked wonder about the mystery of our being and the world we encounter.

Lloyd reacted to criticisms such as those by Frischer and Hurwit,[45] and in a series of publications progressively modified his position. In *Revolutions in Wisdom* (1986), as he did in the 1979 work, he still regarded "rigorous proof," that is, demonstration by deductive argument from clearly identified premises, to be a fundamental characteristic of Greek philosophy.[46] While he was more cautious in his assertions of connection between the political and speculative domains, he still insisted that "the political dimension is crucial for our understanding of some of the distinctive characteristics of early Greek speculative thought."[47]

In the section on "The Argument from Politics," he modified his argument in a threefold manner, emphasizing the political dimension, parallel to the development of speculative thought, in terms of (1) innovation in framing and reforming constitutions, (2) the possibility of dissent from deep-seated traditional views that presupposes political freedom of speech, and (3) revisability in regard to political constitutions and laws. But, here, the argument still resounds in accord with the 1979 work where he emphasized the possibility of radical innovation, the openness of access to the forum of debate, extolled the habit of scrutiny, and fostered the expectation of giving an account and the premium placed on rational methods for doing so.[48]

In *Demystifying Mentalities* (1990), Lloyd once again revisited the origins of philosophy/science. He asked "*How far* do political and social factors help to explain the rise of science in Greece . . . ?"[49] He immediately insisted that there is no simple answer, though he acknowledged some influence. He emphasized a parallelism between philosophical and scientific inquiries and activities in the political sphere. He noted that "evidence" in science and also in both the law courts and history are *marturia*. Some of the proofs, *tekmeria*, aim for what will persuade an audience, though this should be distinguished from Aristotle's *apodeixis*. He denumerated other such terms for testing and scrutiny, *elenchos*, *dokimazein*, *basanizein*. From these kinds of consideration he reached the tentative conclusion that "the style and sophistication of much early Greek philosophical and scientific debate presuppose an audience who were experienced judges of argument, and if we may ask where they gained that experience, the legal and political domain supplies a large part of the answer."[50]

After reassembling the context of his discussion, which he regarded as largely established ("the agonistic features of Greek culture, the extensive political experience of many Greek citizens, and the importance of legal institutions of the Greek city-state . . . and the way that political alternatives were presented or imagined in classical Greek debate . . ."), he asked *how far* can we connect the emergence of Greek scientific rationality with the ideology of democracy? He noted two immediate problems. First, the thesis might fail on the mere chronological grounds that Greek philosophy and science antedate the institutions of democracy, so the latter cannot be a factor contributing to the former. Or the thesis might prove too much since Greek philosophy and science were certainly not confined to the democracies.

He first explored the chronological objection, and this naturally required that he focus upon Anaximander. Lloyd accepted that Thales and Anaximander are roughly contemporaneous with Solon and Pisistratus. If, as can be plausibly argued, the institution of the full democracy at Athens was the result of the reforms of Cleisthenes in 508 BCE, then there can be no question of saying that they could have influenced the first Ionian philosophers. But, for Lloyd, this was not the end of the matter. He repeated the thesis of the 1979 book that "so far as philosophy and science go, what I have taken to be chiefly constitutive of these are the *second-order questions*, and these only begin to be raised some time later than Thales, that is the epistemological debate that begins with Heraclitus (around 500 BC). . . ."[51] So, Lloyd's treatment of the Milesians showed, some eleven years after *Magic, Reason and Experience*, that his approach still belonged primarily to the first tier, that Thales, and presumably Anaximander, could not be accommodated within his criteria, and that if they are to be included it is because he recognized a kind of gradual transition in the development of both philosophical inquiry and democracy that required a grasp of the earlier stages that led up to these decisive changes.[52]

Thus, by 1990, the thrust of the argument was still quite similar but Lloyd was more cautious about the argument; political factors created an environment that fostered and echoed open investigations into matters philosophical, but the causal argument he regarded to be difficult (impossible?) to make with the clarity that would be required.[53] For example, on the one hand, he did not simply ask about the influence of the polis but rather asks specifically about *democratic* practices; on the other, he revisited earlier claims, and while ruling out the sweeping generalizations adopted earlier, he tended to modify them while not dismissing them. For example, "[I]t might be conjectured that the possibility of radical questioning in the political sphere may have released inhibitions about such questioning in other domains. . . . *That cannot be directly shown*."[54] But he immediately noted that there were many Greeks who believed that radical questioning of tradition in politics had particularly far-reaching repercussions on attitudes generally. And in defense he pointed to two passages in Thucydides (III.82, and II,37,40), and one in Aristotle (*Pol.* 1267ff) to support his claim.[55]

Lloyd then concluded chapter 3 by emphasizing the importance of the competitiveness in Greek intellectual life (as in the 1986 work) and the importance for it, as stated in the 1979 work, of "giving an account and the premium placed on rational methods for doing so": In this 1990 work he stated, "[T]hey [Plato and Aristotle] may be said to share . . . one recurrent preoccupation of much Greek political and legal debate, namely the demand for the *justification* of a point of view—except that now, in the highest style of philosophical inquiry, this was redefined as no mere matter of what was subjectively convincing, but on the contrary one of objective certainty, an incontrovertibility secured by rigorous demonstration."[56]

In 1992 Lloyd published a short essay, "Greek Democracy, Philosophy, and Science." It almost fully echoed the 1990 work. He took up again the question of determining the causes that gave Greek philosophy and science its particular characteristics. He balked at the possibility of providing "the" or even "among" the determining causes but explored how "some of the characteristics [in philosophy] appear . . . and reflect the social and political situation in which they worked, and it is these broader connections that we may try to identify as precisely as possible."[57]

In this 1992 essay Lloyd set out five lines of inquiry that he believed to be particularly promising:[58] "(1) the concept and use of evidence, (2) polemical or adversarial manner in which much intellectual discussion was cast, (3) the development of the theories of both rhetoric and demonstrative argument, (4) the privileging, in certain circumstances, of abstract analysis of concrete situations, and (5) the debt of the notion of radical revisability in philosophy or science to institutions of democracy." This list certainly echoed the 1990 work.

When he addressed his fourth point about abstractions, he mentioned Anaximander by name. There, Lloyd tried to make the point that abstraction inevitably involves a kind of idealization. "The constitutional reforms carried out by Cleisthenes at Athens beginning around 508 BC reorganized the entire tribal system on abstract principles. Attica was divided into three regions (city, coast, and inland) and each of the ten new tribes had representative *demes* in each. Even though no direct influence may be involved—in either direction—the geometrization of the political system may be compared to the geometrization of the cosmos. The first attempts at a geometrical model for the heavenly bodies go back to Anaximander around the middle of the sixth century."[59] Once again, Anaximander assumes a place in Lloyd's narrative as part of the background, though the peculiar contribution that Anaximander made is hard for him to say precisely.

Then, Lloyd addresses his final theme of radical innovation. "One striking feature of much early Greek speculative thought is the impression given of the possibility of a radical new understanding of the world, not based on traditional beliefs nor on what was commonly assumed or generally acceptable, but on *reason* alone."[60] This possibility is to be accounted for in a twofold manner: on the one hand, the peculiarity of philosophers, doctors, and mathematicians, but also, on the other hand, in the general belief of the radical revisability of traditional ideas and assumptions. About the origins of this disposition no simple answer can be given, Lloyd again insists. But, "The traditional historiography of philosophy would place a primary emphasis on developments within epistemology itself. However, a further part of the answer may perhaps lie in the political field, since it provided particularly striking instances of the radical revisability of existing constitutional forms . . . especially in the democracies. . . . [T]he principle to which the democracies adhered was that anything could be discussed, that any argument would be given a hearing, that every issue would be decided by democratic vote in the sovereign assemblies."[61] Of course the democracies, in practice, were not always operated the way the ideal suggested, as Socrates found out, but this did not diminish their influence as an ideal. Then Lloyd adds that "even anti-democrats such as Plato and Aristotle hold to the principle of the very greatest freedom of discussion—at least of *philosophical* issues. As to the influence of political structure on other spheres of experience, Aristotle explicitly recognizes that, if custom and tradition are open to radical challenge in the political domain, that has widespread repercussions elsewhere, indeed on *every* branch of knowledge."[62]

By the time we come to the 1996 work, *Adversaries and Authorities*, whereas *Magic, Reason and Experience* had explicitly discussed the parallelisms between the development of the notions of evidence and witnessing, testing, scrutiny, and accountability, in the contexts of law and politics and in speculative thought,[63] expressions such as "Greek rationality is the *product* of the polis" are now eschewed. Why? It seems that Lloyd probably considered that he could not prove the claim with the rigor that the tradition he was trying to illuminate would insist upon. He realized that asserting such a claim would constantly re-engender the objection of some critic who would pose a counterexample or demand what the evidence could never supply—a rigorous proof. So, he chose to excise "product"-talk (i.e., causal talk) from later discussions, and adopted a weaker but perhaps more compelling strategy by means of focusing upon "correlations." By taking this approach he avoids the pitfalls that await all who are prone to such broad generalization. About "philosophy" he says: "I would resist any sweeping generalization to the effect that there is just *one* notion of *what philosophy is* at work in *all* the individuals we lump together under that rubric."[64] Clearly, if Lloyd cannot specify a single notion of philosophy that appears in all the cases, the very idea of providing a causal explanation seems wrongheaded. If one looks back to the series of 1986, 1990, 1992 works, then, Lloyd's preferred strategy is to explore connections in terms of correlations. Thus, Lloyd cautiously and carefully draws our attention from one domain to another in displaying this approach: look here at these political matters, now look over there at these philosophical matters, now there at these mathematical or medical matters, now again over there at these legal matters. . . . Well, what shall we think? Too much coincidence and overlap to neglect. Can we assert causal connection? Too strong a demand, either way the evidence for it is not there. Rather, we must recognize "correlation" that "suggests" interrelation, "perhaps" influence, the "likelihood" of contribution, and so on.

But Lloyd's 1996 work also includes Anaximander in discussions about ancient philosophical issues such as the nature of opposites, the nature of infinity, and the desire for an ordered structure of the cosmos. In these discussions, Lloyd refers to Anaximander as a "Presocratic philosopher,"[65] and such descriptions suggest that Lloyd's positions continue to carry forward an ambivalence about him. Indeed, Anaximander's influence on the philosophical goal of finding an ordered structure of the cosmos is worth emphasizing. While it seems true, as Lloyd suggests, that Anaximander's motive for the systematic positioning of the sun, moon, and stars is merely symbolic, the very inclusion of him in such a discussion could arguably be interpreted as a primitive attempt toward the formulation of a rigorous proof. The fact that Anaximander's cosmic structure failed to be functional in the prediction of celestial events does not mean that such predictions were not goals Anaximander might plausibly have had in mind when searching for cosmic order. After all, the creation of a seasonal sundial, reasonably attributed to Anaximander, most certainly had among its goals accurate prediction of celestial events. To challenge Lloyd's various pronouncements is to urge further the inclusion of Anaximander as "philosopher," on the grounds that his contribution is significant to the gradual process of rejecting supernatural fancies, endorsing rational explanations, and moving forward a new kind of discourse to meet the increasing demands for rigorous proof and second-order questions about the nature of the inquiry itself.

So, to sum up, Lloyd's studies on the origins of Greek philosophy have followed a first-tier approach. Identifying rigorous proof and second-order questions about the nature of the inquiry as fundamental defining characteristics, he has investigated explanations of the rise of this mentality. In 1979, Lloyd examined four competing hypotheses all of which have had defenders and all of which he rejected as sufficient conditions. Even then, Lloyd advanced a fifth hypothesis, namely, political dimensions, to explain the innovations in Greece that apparently did not emerge elsewhere, and almost twenty years later we find him still refining the political and legal factors that are central to his exegesis. Of the four hypotheses (leisure, intermingling of beliefs, technology, literacy), technology, dismissed in a rather wholesale manner in 1979, makes no contributing reappearance later; so also for leisure and intermingling of beliefs. While literacy enjoyed renewed consideration in the 1986 work, only to be rejected, it is also clear that literacy could not play the crucial role. By the 1996 work he could say again (arguing to avoid generalizations), "It was all the product of literate individuals at least but that does not take us very far,"[66] for he acknowledged important medicinal and scientific activities produced by Chinese traditions that were perhaps not even literate.[67] Thus, while there is nothing in Lloyd's work to suggest that these conditions did not create a situation that positively helped philosophical and scientific activities to develop, none could be regarded as sufficient conditions; Lloyd abandoned them broadly in 1979 on the grounds that all the other civilizations, contemporaneous and earlier, in Egypt, the Near East, and Mesopotamia enjoyed these ingredients in abundance and apparently never developed philosophy. The political themes, however, that had been so recurrent in his work appeared again in 1996, in the chapters on the adversarial and agonistic traditions and the conditions that made challenge to prevailing authority possible (chapter 2), the techniques of persuasion and "proof" (chapter 3), and again methodologically, on causes and correlation (chapter 5). Thus, the main thrust of his 1979 work has not been abandoned though it has been refined. He has weakened his claims, by appeal to correlations rather than alleged causal connections, but his purpose seems much the same, to suggest a dynamic interplay in which philosophical and scientific activity were in some large measure echoes, if not emblematic and symptomatic, of political transitions; and the transformed society pursued philosophical and scientific activities that in turn fuelled the community and the political institutions.[68]

We are now in a position to try to reconstruct Lloyd's position as it has been developed, and then offer the challenge to it.

It might go something like this. For Lloyd, we should regard epistemology and ontology as defining characteristics of "philosophy" proper. If Anaximander deserves to be counted as a philosopher, the argument must show the evidence for Anaximander's contributions, that is, the appropriate explananda. Perhaps Anaximander made a map of the *oikumenē*, a seasonal sundial, a map or model of the cosmos that he discussed further in a prose book. Perhaps he proposed a rationalized cosmology, attempted to explain the origins of all things, sought to promote a vision of cosmic justice on analogy with human justice, and offered some account of our biological evolution from the sea. Even if he did all these things, we have no relevant evidence for his contributions to epistemology and ontology, or not enough to decide the issue. Or, perhaps, we do not have sufficient evidence to make it clear that Anaximander approached these matters in what we should regard as a philosophical manner. Thus, the place of Anaximander as "philosopher" cannot be further advanced because so little can be deduced from the secure evidence for him.

The challenge to Lloyd's position might be framed in a hypothetical way. Suppose we could go back in time and have a discussion with Anaximander. Would we come away thinking that our conversations could be described meaningfully as "philosophical?" And if so, how would those conversations differ from ones we might have with Homer and Hesiod, some of which might surely strike us as having philosophical dimensions? It seems reasonable to conclude that we could have conversations with Anaximander that we could regard as philosophical. Not the experience of a meeting of the American Philosophical Association, of course, but broad and philosophical discussions could be had, no less. We might discuss whether there was a single stuff out of which all things were made. We could ask him why Thales' *hudor* or Anaximenes' *aer* might not be the best assignments, and what other candidates might be supposed to underlie all material things. We could ask Anaximander, and it seems quite reasonable to suppose that he could hear us, what strange kind of question he was answering in supposing that the *apeiron* was the origins of all things (and into which all things return?). And did he mean that the *apeiron* was merely the origins of all things or moreover the primary stuff out of which all things are made, that is, the material cause. We certainly might discuss what the differences seemed to be between his cosmological descriptions and those of Homer and Hesiod, and how it was that his rejection of supernatural explanations and his promotion of rational discourse highlighted his vision of the way things are. Certainly, we could ask him precisely what he meant by *apeiron*—that is, specifically something unlimited in quantity, or rather indefinite in quality, or both—and how he would articulate further *how* the many appear from what is ultimately one and unitary? Having apparently rejected mythological and supernatural accounts, we could press Anaximander further about the mechanics by which the many appear, and to invite him to compare and contrast how his prose account differed from other descriptions couched in poetic meter. Did he know the *Heptamychos* of Pherecydes, and moreover, how did he understand his prose treatise to differ from it? Walking the sacred road from Miletus to Didyma, which was lined with dedicated sculptures some of which he might very well have financed himself, we could ask him about the prevailing political situation and what the ideal political situation might be, and furthermore, what precisely are the grounds for suggesting a connection between human justice and cosmic justice, and the possible relation between his trifold division of the cosmos and the trifold social divisions that might have been part of his archaic community. Did he have a utopian conception of the cosmos?[69] We could surely ask him, in a meaningful way, why he believed that the stars, which seem to us to be occluded when the bright moon is in the sky, seemed closer than the moon? He might well find it meaningful to respond to the problem of how to account for this perceptual problem. Was it (as Kahn suggested) the rational argument, that what is more fiery is farther, and since the stars are not brighter (less fiery) then they are not farther? Or was it (as Burkert maintained) that the heavenly order is adopted from the Avestan tradition? And if he took his hint from the Zoroastrians, how should he deal with the challenge that our perceptions might seem to undermine the proposed order? It is fully believable that Anaximander made a seasonal sundial since it was indispensable to his marking out the frame of his earthly map.[70] Accordingly, we can reasonably imagine asking him how his gnomon works, what suppositions he made concerning its use, why he believed his results (perhaps discussed in Sparta?), and moreover, what else could he determine through its employment? We could ask him how the conditions for testing the gnomon differed from testing the earthly map. Similarly, we can imagine asking what convinced him that his map of the *oikumenē* was reliable, what counted as evidence for it, did he appeal to a portulan system of navigation for confirmation, and by appeal to what further considerations—what should count as "evidence"—might his map be improved? Moreover, we could press on in our discussions by asking Anaximander how he might test his idea of his cosmic cartography, and how this problem might seem both similar to and different from the problems of testing the gnomon and the earthly cartography. And, of course, we could surely imagine asking him about his views on human origins, why he might have supposed that, long ago, we came from the sea, how we changed along the way, why he supposed we did, and what implications did he draw from his account.

In these kinds of conversations, we would go away from Anaximander convinced that he was up to something that was leaving the beaten path in archaic culture. In retrospect, we could see meaningfully that he was a transitional thinker. Some of our questions might surely catch him by surprise, of course, but we are trying to make sense of a new road that was being paved, not the well-established superhighway whose defining lines we would find sometime later. These hypothetical reflections seem helpful as we try to get clearer about whether or not Anaximander deserves to be considered a "philosopher." These reflections help us to consider how, as a transitional thinker, Anaximander deserves to be part of the story of the rise of philosophy, gradual as it must be in its emerging stages.

One way to approach the question, then, of what is missing from Lloyd's learned research, is to revisit the issue of what kind of background correlations relevantly informed Anaximander, and Thales. The emphasis on democratic politics seems a less promising standpoint from which to illuminate these earlier episodes. By turning to the technology of monumental architecture, and then its political contextualization—who paid for it and why?—a hypothesis that Lloyd quickly abandoned in 1979 can make a much needed reappearance. Technological innovation illuminates the background and still connects to the general political theme while, at once, bringing with it other interwoven cultural ties. Twice Lloyd refers to Anaximander's cosmos in his 1996 work when he singles out the selection of numbers 9, 18, 27 as "symbolically appropriate"[71] but he never tells us what the symbolism means nor whence it is derived. Moreover, in the remarkable breadth of Lloyd's scholarship it is not less remarkable that he almost never speaks about architecture or its techniques, and the possible influence such activities might have had on early Greek philosophy.[72] Although, arguably, no peacetime enterprises so powerfully affected the archaic communities as did the monumental projects in eastern Greece and elsewhere, it appears that the possible influence of architectural technologies rather completely escaped his notice.

## The New Contributing Thesis: Technology as Politics

The conventional view of the rise of Greek philosophy offered five hypotheses that plausibly and perhaps significantly contributed to the emergence and development of Greek philosophy: leisure, intermingling of beliefs, literacy, technology, and the polis. The hypotheses form a cluster of factors that help us realize more deeply the dynamic conditions at play from the sixth through fourth centuries BCE, and they invite us to wonder about their complex interrelations. The new contributing hypothesis proposed here makes no pretense to provide an unexplored *sufficient* condition to account for the origins of Greek philosophy; rather, it offers an examination of a slice of this well-formed pie of hypotheses by drawing our attention to a historical contingency that has not been adequately appreciated. The slice is the one that overlaps two familiar explanations—technology and polis—and consequently will be called *technology as politics*. The new thesis does not require the invocation of a wholly new paradigm because it accepts the broad correlations suggested by the well-established five. However, this line of thought seeks to open new ground on the so-called "third tier"—a new explanation of the rationalizing activity fundamental to the rise of philosophical thought in Greece—by exploring a source of influence traceable to Egypt. For the case to be made, in outline, is that the Egyptian architects inspired and tutored the archaic Greek architects, and they in turn, influenced Anaximander's mentality. Moreover, this new picture requires an explanation of the cultural context, the social and political motivations for monumental temple building, that brought the architects to center stage so that they could affect Anaximander and his community.

Several scholars have argued the much stronger claim, that everything we admire about Hellenic civilization was derived ultimately from Egypt—the so-called Afrocentric hypothesis.[73] The more extreme versions of that thesis have been refuted adequately by Lefkowitz, for example.[74] The claim being made here is much more modest, that Hellenic architects learned some valuable technical things from studying Egyptian structures. It is obvious to anyone who compares Hellenic with Egyptian monumental temple architecture that there are important differences in style and function. The Greeks were not simply imitators in architecture, but they did not develop the entire art from ground zero either. Possibly they learned a few things that were both relevant and material to their philosophical activities but they were certainly not imitators of the Egyptians in philosophy. In any case, the architectural relationships are the present theme, and a new and previously unexplored route into the Egyptian influence on early Greek natural philosophy is going to be surveyed.

At the same time, the new thesis explores the contributing role of technology[75] in monumental temple building, by exposing why, perhaps, this avenue has not been appreciated. There are two important considerations. First of all, Greek philosophy is customarily identified with efforts to *de-mystify* the world. The temple, however, is a chief instrument of *mystification* programs in antiquity, and so does not suggest itself readily as a likely source of de-mystification. Perhaps for this reason, temple architecture was routinely passed over along with the temple. Secondly, because Greek philosophy à la Plato and Aristotle—the first-tier approach—has been commonly interpreted to recommend that philosophy begins by rejecting the contributions of the body and the senses as candidates for knowledge, the contributing role of the architects and their productions (indeed, *technē* in general) have been routinely passed over without much comment. The new thesis invites us to rethink the Milesian innovations—second-tier approach—and to try to push back the discussion farther still to the earlier third tier of explanations. The third tier is not simply the sociopolitical complex out from which the Milesian innovations emerged; instead it seeks to offer an explanation within that sociopolitical context about what motivated Anaximander's rationalizing prose discourse. Thus, while Cornford sought to unfold the second tier in terms of Babylonian and Hesiodian poems about origins, and Vernant sought it with political narratives, and Burkert and West sought to explore the third tier background in terms of Persian religion, so here we shall investigate archaic architectural influence, and show how it fostered Anaximander's rationalizing.

The innovations of the Milesians, as Aristotle declared in *Metaphysics A*, mark part of the early horizon of Greek philosophy/science. The role of "philosopher" was new with those such as Thales and Anaximander. But new roles do not emerge *ex nihilo*.[76] They emerge against a background of social roles in which the new innovations represent a meaningful departure. It was this point of view that inspired an earlier study reappraising the origins of early Greek philosophy. In that essay "What did Thales want to be when he grew-up?" the thesis was first argued that the architects/engineers engaging in monumental temple building in the first half of the sixth century BCE played a contributing role that has been far from fully appreciated. That study led to the preliminary conclusion that although technology (i.e., *technē*) was not a sufficient condition to account for the innovations of Thales (and Anaximander), it nevertheless played a significant and vastly underestimated role in stimulating those efforts. The view adopted there was in need of refinement and has since led to new, more intriguing hypotheses about the social community in archaic Greece.

To argue for the new contributing thesis, *technology as politics*, we must open up a previously unexplored aspect of the second tier, the sociopolitical background against which the Milesian innovations of Anaximander represent a meaningful departure. Then, we must show how this source of influence helps to explain what none of the earlier studies have, namely, *why* did Anaximander rationalize the cosmos—the new third tier. Thus, the following cases are to be made:

### Chapter 2

In order to understand Anaximander's originality we must come to grasp it in his own cultural context, to see an interaction between two social communities that has not been addressed, perhaps because we did not suppose that "philosophers and intellectuals" would have much to share or learn from the community of "house builders." We begin with the claim that Anaximander was credited with the first prose philosophical treatise. When we seek to determine who else in archaic Ionia was writing prose treatises, we discover that the Ionian architects were also credited. We follow this lead and inquire who else besides Anaximander and Thales was making drawings and perhaps building models, diverting rivers, inventing tools and applied geometrical techniques? Again, the archaic architects Theodorus and Rhoikos, Chersiphron and Metagenes, prove to be a revealing but unexplored source. The Ionian *phusiologoi* and *architectōnes* represent communities of shared interests and activities. And when we wonder where the Greek architects, in the absence of any monumental building projects for hundreds of years, would have gained both the inspiration and techniques to do so, we trace out a likely account of how architectural technologies were transmitted to Ionia from Egypt.

## Chapter 3

Once we acknowledge the connection of Egypt and Greece in terms of the transmission of architectural technologies, the task before us is to consider which ones might be relevant to an understanding of Anaximander's innovations. We focus upon four techniques: (1) imagining in plan view, and the kinds of written instructions and corresponding drawings that this approach fostered, (2) model making connected with architectural technologies, (3) the theory of proportions to account for procedures of architectural design, and (4) the technique of *anathyrōsis* and *empolion* to prepare column-drums. Since the evidence on all accounts is often modest, we attempt to trace out what we know about the architectural techniques from Egypt and then examine the similarities and differences that emerge from an inspection of the archaic Greek evidence.

## Chapter 4

The argument then continues that Anaximander, having been influenced by the community of architects, undertook his own projects. After attempting reconstruction drawings of the cosmos derivable from Homer and Hesiod, Anaximander's cosmos is set out in both plan and orthographic projections other than plan, and the plausible use of other architectural techniques is explored further. The plan view offers to resolve a difficulty presented by Aristotle's testimony and to demonstrate Anaximander's peculiar indebtedness to the architects. Then, after attempting to reconstruct his map of the *oikumenē*, by showing how his seasonal sundial (the reconstruction of which is also attempted) was instrumental to making a terrestrial map, efforts are made to picture Anaximander's cosmos in elevation, side view, and other three-dimensional views, as was suggested by the changing elevations of the sun identified by his gnomon.

## Chapter 5

Finally, we turn to work out the consequences of this new approach to illuminate further the cultural context in which "Greek Philosophy" has its peculiar and original beginnings. What does the new story—*technology as politics*—look like? If temple building contributed to Anaximander's philosophical conceptions in a way that has not been grasped, then temple building and the community of architects contributed to the origins of philosophy in a way that has not been grasped. When we tell this new cultural story, we must come to grips with the sociopolitical motivations for temple building. We must explain who paid the architects and brought them to center stage so that they could affect the archaic community in general and Anaximander's philosophical and cosmological conceptions in particular. We must ask, why were the archaic patrons financing these extraordinarily expensive temples to Hera, Artemis, and Apollo? What did these patrons believe they were getting for their enormous investment? And this will lead us to pose and to try to answer the question, "How is it that Greek philosophy emerged in the context of a story of sociopolitical transitions and the struggle for power?" The new story proves to reveal another aspect of the origins of philosophy within its cultural context. Seen from this new perspective, Greek philosophy emerges as an unanticipated consequence of an aristocratic effort to bolster a failing authority. That effort produced far-reaching consequences that the aristocracy could hardly have foreseen fully. The complex result was the further erosion of traditional archaic aristocratic power with the rise of egalitarian reforms. And this intriguing story requires us to see that as power was shared by more people in the fifth and fourth centuries with the increasing democratization of society, philosophy flourished contemporaneously, curiously enough, led by Plato and Aristotle, whose sympathies were neither democratic nor egalitarian. This complex sociopolitical story traces the outlines of transitions from archaic to classical Greece: on the one hand, the diminution of traditional archaic authority with the increasing egalitarian and democratic reforms; on the other hand, the thriving of rationalizing accounts from Anaximander to Plato and Aristotle.

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# 2

# *The Ionian Philosophers and Architects*

## Fixing Anaximander's Date: The First Philosophical Book in Prose

There is some likelihood that Anaximander "published" his book in 548 or 547 BCE,[1] though the assignment of the mid-sixth century has been routine. As Burkert astutely observed for Heraclitus, the dedication of his book in the temple of Artemis in Ephesus was the act of making his book public, that is, publishing it.[2] Perhaps Anaximander dedicated his book in the temple of Apollo in Didyma whose monumental construction is now thought to have begun in the late seventh or early sixth century, more or less contemporaneously with the monumental construction of the Ephesian Artemision, 'c'.[3] In any case, there had been in Didyma, whose patron city was Miletus, a grove of laurel trees, the ones sacred to Apollo, in a precinct around which the huge hypaethral *adyton* would soon be constructed. The sacred grove was undoubtedly connected to earlier cult practices as was the sacred lygos tree for the cult of Hera on Samos. Perhaps, then, in Didyma, or in the Samian Heraion, or even the Ephesian Artemision,[4] Anaximander dedicated his work as did Heraclitus about a half-century later. Whatever the earliest mode of making one's work public, the date may be plausibly established to have roughly coincided with the year before the fall of Sardis (547/6). Why?

The likelihood of this date for Anaximander's act of making public his thoughts rests on the testimony of Apollodorus of Athens (c. 180 BCE) preserved by Diogenes Laertius. Diogenes reports the findings of Apollodorus as stated in his *Chronicles*, a work based on the researches of Eratosthenes, the second-century BCE librarian in Alexandria. Apollodorus states that Anaximander was sixty-four years old in the second year of the fifty-eighth Olympiad (c. 547/6).[5] This claim is consistent with the one provided by Hippolytus that Anaximander was born in the third year of the forty-second Olympiad (c. 610/9).[6] Pliny further confirms the dating of Anaximander even if he wrongly attributes to him the discovery of the obliquity of the zodiac.[7] That discovery more likely belongs to Oinopides of the fifth century but Pliny credits Anaximander with the insight and assigns a date of the fifty-eighth Olympiad.[8] But where or by what means did Apollodorus extract this specific information?

Apollodorus tends to follow the general rule of placing a thinker's *floruit* at forty years of age, and making the master twenty years older than his student/disciple.[9] Thus, by his own reckoning, Apollodorus ought to have claimed that Anaximander flourished in c. 565 BCE, halfway between Thales (c. 585 BCE) and Anaximenes (c. 545 BCE). The consequence would be that Anaximander should then be sixty in 547/6 rather than sixty-four. That he does not do so speaks in favor of this specific dating. In this case it is the *lectio difficilior*.

The fact that Anaximander's age is known not by his *floruit* and not by his death (although close to it) is a significant point.[10] His date, and specifically his age, is likely established by something in his book, a book not identified with his flourishing at forty but rather with the publication of his thoughts preciously close to the end of his life. If Apollodorus could claim that Anaximander was sixty-four years old in Olympiad 58.3, he must have found something in Anaximander's book, or a summary version of it, that allowed him to do so. For Diogenes to claim that Anaximander "died not long afterwards" suggests that Apollodorus assigned his death to coincide with the fall of Sardis (547/6), one of his regular epochs. Since, as we know from Xenophanes, the question, "What age were you when the Mede came?"[11] was considered interesting at the time, perhaps Anaximander announced his age in his book by reference to some such event. Thus, the identification of the unusual "sixty-four" with Olympiad 58.3, and Pliny's assertion of Olympiad 58 for some achievement both suggest that there was something in Anaximander's book to secure this assignment.[12] This reasoning makes sense; the publication of Anaximander's book, then, may be plausibly set in 548 or 547 BCE, and his death shortly thereafter.

The purpose achieved by securing a reliable date for the act of making public Anaximander's thoughts is to invite a consideration of prevailing conditions that might have influenced Anaximander's conscious decisions in forming those thoughts or at least prompting his publication of them at that time. That Anaximander wrote a book is beyond doubt; the proof of this consists in the quotation from it preserved by Simplicius on the authority of Theophrastus.[13] Two points in the surviving fragment are especially worthy of attention here.[14] First, the fragment is in prose rather than the hexameter of Homer and Hesiod, the lyrics of Alcaeus, Sappho, or Anacreon, the choral lyrics of Alcman, Stesichorus, Simonides, Bacchylides, or Pindar, the iambics of Archilocus or Semonides, or even the elegies of Callinus, Tyrtaeus, and Mimnermus. Secondly, the vocabulary contains expressions decidedly poetic in character. Thus, although displaying the use of terms familiar to established modes of poetic discourse, Anaximander stands at the outermost edge of this tradition stepping forth into a new domain.[15]

Who else in archaic Greece was writing in prose and making that writing a public matter? What evidence is there for prose writing in Greece contemporaneous with and prior to the publication of Anaximander's thoughts usually titled *On Nature* (*peri phuseōs* [*tōn apantōn*])?[16] There are three sources of which we reliably know: Pherecydes' prose theology, prose inscriptions of legal codes, and prose treatises by the Ionian architects.

## Archaic Prose Writing: Pherecydes' Cosmogony and Legal Inscriptions

Pherecydes of Syros, roughly contemporary with Anaximander, perhaps wrote the first prose book. But later doxographers distinguished between the *theologos* or "the preacher who declared things were so, as if he had access to hidden knowledge," and the *phusiologos* or "the reasoner who tried to establish laws of nature."[17] Pherecydes came to be regarded as a *theologos* while Anaximander became identified with a *phusiologos.* In this sense, Anaximander is credited with writing the first *philosophical* book in prose. What is striking in similarity is that Pherecydes' book, known by the title of *Heptamychos* (*Seven-Chambered Cosmos*), is a cosmogonic myth. From the scanty reports of it, it seems that the book sought to explain the origins of the cosmos, but in mythic terms, and some scholars have seen in it signs of Ionian rationalism.[18] The book displayed themes that foreshadow or echo Anaximander; these recurrent themes help us to see a range of ideas that enjoyed currency in archaic Greece. Pherecydes' book dealt with cosmography, perhaps he saw or made a map of the *oikumenē*, and he seems to have envisioned the cosmos, or a significant part of it, as a great tree.[19]

His book offered a cosmogony, an account not only of the past but also of the world as it is now, and seems to have resembled Hesiod's *Theogony*.[20] Unlike Hesiod, however, who related the birth of the oldest gods, Pherecydes began his fable with the assertion that "Zas, Chronos, and Chthonie have existed forever," and thus shared an attitude with Anaximander that cosmogony must begin with an eternal and ungenerated *archē*.[21] In mythical imagery, Pherecydes related a cosmic marriage in which a "winged oak"[22] or "tree"[23] bore Earth's embroidered robe, and so played a central role.[24] West contended that, in the context of a cosmic marriage, the winged tree comes to assume a central place in the physical framework of the cosmos.[25] Unlike Hesiod who spoke of the roots of the earth, descending downward into the lower regions and making it secure, Pherecydes' tree does not seem to have been comparably "rooted," for then its wings would have been pointless. In any case, West pointed out that the Cosmic Tree is a conception unfamiliar in Greece but well established in Babylonian, Egyptian, and Indian sources, and thus was imported from the East.[26]

Pherecydes, perhaps, made or saw a map of the earth. He says that Zas (i.e., Zeus), on the third day of the wedding, made a robe on which he embroidered Earth and Ogenos (i.e., Ocean). West argued that the robe represented the terrestrial world, and like Homer in the account of Achilles' shield,[27] Pherecydes is imagining great divisions of the world. If so, perhaps Pherecydes has in mind a map that he had seen, or one that he had made, on which such divisions were prominently marked.[28]

So, what can we conclude from these reflections upon Pherecydes? Contemporaneous with Anaximander, we have evidence for prose writing on cosmogonical themes. On the one hand, the present state of the world had not always been this way, but followed from preceding stages unlike it; on the other hand, in prose not poetry, the anthropomorphic *archai*, Zeus and Time—not the *apeiron*, an eternal *archē*—always existed. Pherecydes saw or made a map of the inhabited earth, and in any case imagined terrestrial cartography. And by means of tree imagery, the comos was imagined. Thus, breaking from the earlier traditions of expressing cosmic ideas in metered discourse, the archaic world in which Anaximander flourished had at least one other example of cosmogony in prose. Prose writing thus became a vehicle for accounting for origins, the cosmic beginnings, and the place that humans came to acquire within that great story. And prose writing also became a vehicle for explaining, not only nature's order, but also human order. To see this, we must turn to consider prose legal inscriptions.

Contemporaneously and earlier, there is evidence both literal and inscriptional for the prose writing of legal procedures. The eloquent case made by Gagarian[29] joins forces with Lloyd's polis hypothesis, that the enactment of written legislation established without doubt the authority of the polis over its inhabitants.[30] The motivation to write down legal procedures and codes was a fundamental part of the effort to consolidate the power of the polis over the contending authority of aristocratic families that had previously controlled matters of justice.

Before Gagarian argues for his view, he entertains four competing hypotheses that have enjoyed currency. He sets the stage for this debate by acknowledging that although formal procedures for settling disputes were well established before the introduction of writing, from the mid-seventh century through the early sixth century, some Greek cities had written laws.[31] Furthermore, he embraces the stance adopted by Havelock that justice in early Greece was a "procedure" not a "principle," in order to describe the character of early legal efforts.[32] Why, then, did the Greeks initiate public inscription of laws and the acts of legislation necessary for public inscription?

Against the first competing hypothesis that written laws were democratic developments in response to the public demand for equal justice, Gagarin objects that there is no evidence that the earliest Greek lawgivers viewed their laws as restraints on absolute power.[33] In opposition to the second hypothesis that written laws were democratic developments in response to the needs of trade whereby the growing merchant class sought to wrestle the control from the aristocrats, Gagarin argues that there is almost no evidence for such laws and consequently this cannot have been a primary motivation for writing them down.[34] In response to the third hypothesis that legal writing was inspired by Near-Eastern influences, especially in Crete by settlements of Semitic craftsmen, Gagarin draws our attention to the radical discrepancy between the rather exclusive early Greek concerns with legal procedures as opposed to Near-Eastern codes that were almost entirely substantive and thus dismisses the case for a direct connection.[35] Finally, Gagarin objects to the fourth competing hypothesis that the writing of laws was a direct consequence of the colonizing movement of the eighth and seventh centuries whereby colonists recruited from different cities and obeying different customary laws were in immediate need of legal organization. He points out that the earliest written laws appear in Athens and the Cretan cities that were not colonies, and that for the most part colonies were constituted rather exclusively by settlers from only one mother city and hence would have shared customary law.[36]

Gagarin accepts the picture of archaic society advanced by Glotz that the growth of the polis during the archaic period took place side by side with the general breakdown of the traditional control exercised by the head of the *oikos*, that is the "household" or "extended family."[37] With the dissolution of traditional tribal authority, together with the vastly expanding polis, opportunities for conflict must surely have increased and the need for establishing procedures for settling disputes must have been correspondingly great. Thus, in the archaic period the Greek cities were expanding their power at the expense of individual families. In response to burgeoning conflicts, so many of the growing cities envisaged the need for written laws, publicly displayed. In that process the authority of the polis was confirmed and a new order was progressively visited upon the Greek city. As Snodgrass had said of the Greek temple so Gagarin says of written laws, these actions were aimed to consolidate the divergent ingredients comprising the polis.[38] And Gagarin's thesis echoes Lloyd's polis hypothesis; written law, with its emphasis on legal procedure rather than content, is motivated by the development of the polis and is an expression of the peculiar kind of rationality that also found expression in philosophy/science. What makes the intellectual developments in Greece distinct from earlier developments in the Near East, Egypt, and Mesopotamia in general, is the polis, a new organization of the society that made it possible for individuals to come to a new vision of their human nature and a new range of social roles and possible enterprise. These political changes certainly played a contributing role to the flourishing of philosophy (first-tier approach) and these new ideas must surely have circulated in cosmopolitan Miletus. But this polis system with its recommended participatory form of government was both less prominent and less decisive in Miletus in the first half of the sixth century BCE (objections from the second-tier approach).

The newly introduced activities of writing down laws, that is writing down procedures for legal applications, might plausibly have found expression in the only surviving fragment of Anaximander's writings. In that fragment, legal models recommending the payment of penalties (*didonai dikēn*) for injustice (*adikia*) are called upon to illuminate natural procedures.[39] While the writing of human law was detailing procedures for ensuring justice, Anaximander could have been inspired to see nature's procedures that ensure cosmic justice and reassure the possibility of a justice that wins out in the end, a triumphing natural justice that will ultimately appear on earth.[40] This is all the more striking if we recall the ongoing turmoil in Anaximander's Miletus. Perhaps, following Hurwit's suggestion that Milesian nature speculation sought an escape from the ravages that they were forced to endure, Anaximander's vision of cosmic justice could be seen as a prediction no less startling than the one attributed to Thales by Herodotus that day would become night. Anaximander, the politically active member of his community, credited with founding the colony of Apollonia (on the Black Sea?), sought to foretell for his fellow Milesians the ultimate prevailing of justice in human matters on the grounds of the order and justice-preserving procedures he discovered in the cosmos. And like the legal procedures, they were written down in prose.

Thus, prose legal writing might be seen to ensure the very justice that was being increasingly challenged by changes in the political and social structure. These prose writings testify to the importance of legal procedures, recommendations that increasingly played significant roles in the restructuring of a social order that, in turn, progressively gave rise to a fundamentally new and *rational* vision of human identity. The prose writing of Pherecydes and those of legal procedures advance our discussion, then, in two principal ways:

(1) Prose writings about cosmic beginnings offered quite literally a new beginning against traditional conventions for reflections upon human identity and our place in the grand scheme of things.

(2) Prose legal writings help us to focus upon socio-political transitions in the archaic period in which traditional aristocratic authority was increasingly relegated to a diminished sphere of influences with the flourishing of the polis, its democratic reforms, and its egalitarian practices.

While an understanding of the emergence of prose writing and the sociopolitical context that underlay it will help illuminate Anaximander's prose expressions and what these could have meant to an archaic audience in Ionia, it will not illuminate Anaximander's inspiration for thinking of the earth as a column-drum nor the curious and striking geometrical proportions of his universe. For this influence we must look to another source, one that was also interwoven in the complex and turbulent fabric of archaic Ionian society and just so happened to express itself in prose writing: the architects.

## Prose in Archaic Architectural Treatises and the Community of Thales and Anaximander, Theodorus and Rhoikos, Chersiphron and Metagenes

In Xenophon's *Memorabilia* Socrates is made to ask the sophist Euthydemos, who has made a collection of technical treatises, whether he is planning to become an architect.[41] The sarcasm, of course, would be pointless unless architects were accustomed to learn from other architects by means of written treatises. Evidence for a tradition of archaic architects writing prose treatises can be traced back to Vitruvius of the first century BCE in his *Ten Books on Architecture*.[42] Those architects are identified with the first monumental stone temples in precisely the geographical region from which Anaximander hails and at precisely the time when he flourished and published.[43] Further, the list of achievements, real or imagined, with which the architects of the archaic temples are credited—to Hera in Samos, to Artemis in

Ephesus, and to Apollo in Didyma—reads like a list attributed to Thales and Anaximander. The coincidence is stunning as is the fact that the possible connection has been all but neglected.

Thales is credited with many accomplishments. Those possible achievements have been subjected to considerable scrutiny with mixed results. Rather than debate the veracity of particular accomplishments our purposes here will be better served by drawing attention to the general kinds of achievements with which Thales, Anaximander, and the contemporaneous architects are credited in order to discover a possible kinship or "family resemblance" of interests. The result will be an understanding that *all* these individuals gained wide recognition for feats in *applied geometry*.[44]

Thales is credited by Herodotus with the prediction of some astronomical anomaly, generally spoken of as a solar eclipse (28 May 585 BCE).[45] He is credited with a technique, or its application, for measuring the height of a pyramid.[46] The technique, generally supposed, seems more an example of his cleverness than of mathematical skill for it required that he measure the length of the shadow of the pyramid at the time of day when his own shadow was equal in length to his height. The marvelous aerial photograph, opposite, allows us to reflect on Thales' alleged achievement. Here, we see the pyramid of Khaefre on the Giza plateau and its enormous shadow.[47]

In keeping with the mercantile economy of Miletus, Thales is also credited with measuring the distance of a ship at sea.[48] And he is recognized for supplying a technique for celestial navigation making use of the Little Bear, *Ursa Minor*.[49] Thales also gained renown for allegedly diverting the river Halys for Kroisos's army to pass.[50] Herodotus does not believe it since he claims that there were already existing bridges but what is significant in this story is that such an enterprise was within reasonable belief, could meaningfully be applied to Thales, connects him unmistakably to the camp of a tyrant, and identifies him with feats in engineering.[51] According to Diogenes Laertius, Thales received the title *sophos* in 582/1 BCE, likely a consequence of his prediction of some event in the heavens that brought an end to the war between the Lydians and Medes.[52]

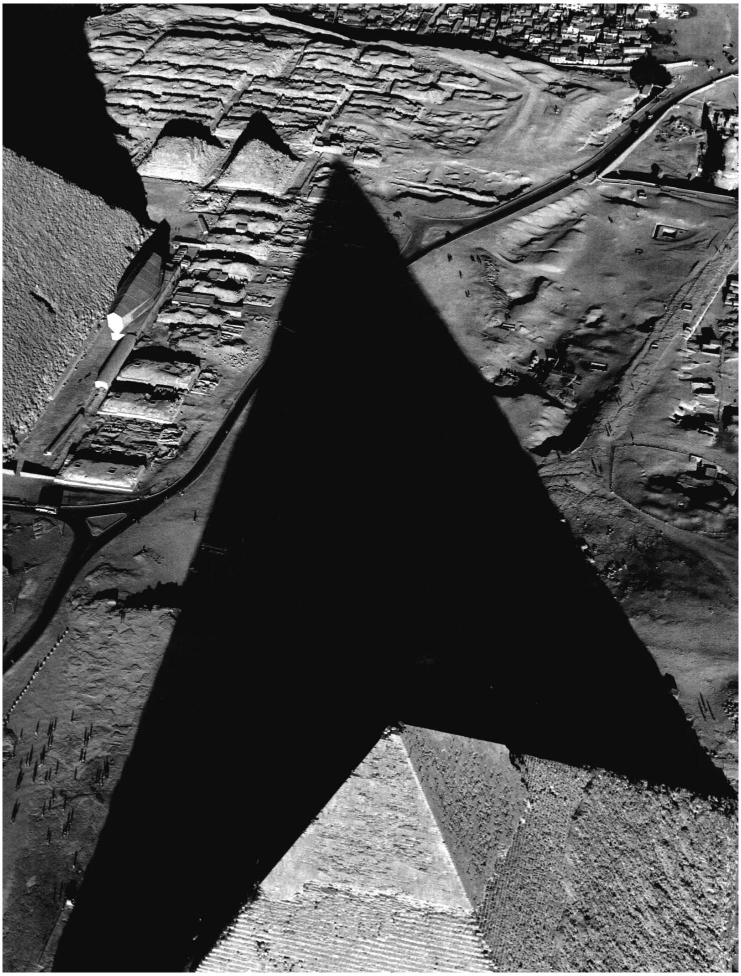


*Figure 2.1*

*Aerial view of the pyramid of Khaefre and its shadow, Giza Plateau*

Thales is thus pictured as a man who believed that the cosmos has an order and that mortals can come to know it. The knowledge of the order in nature makes it possible to both predict and affect events permeating the daily lives of mortals. The proof consisted in claims about future configurations of the heavens, measuring heights and distances, diverting rivers, and so on. In the same spirit, Thales is credited with introducing geometry into Greece[53] and perfecting several theorems, that is, he is credited with introducing *proofs*. Thus, at the very beginning of Aristotle's *historia*, we find Thales who, not satisfied with asserting how things are, sought to offer the chain of reasons that explained how things came to be. In a phrase, Thales' *modus operandi* advances the very ideal of rigorous proof.

Below, we begin to reflect on the geometrical diagrams that would later be identified with the proven theorem: (a) a circle is bisected by its diameter;[54] (b) the angles at the base of an isosceles triangle are equal;[55] (c) if two straight lines intersect, the opposite angles are equal;[56] (d) the angle inscribed in a semicircle is a right angle.[57]

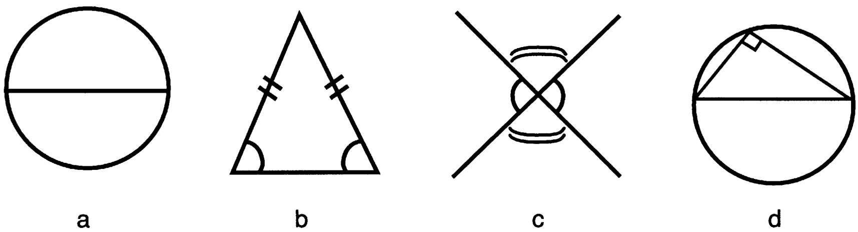



*Figure 2.2*

*Geometrical figures corresponding to Thales' theorems*

On Thales' reported achievements in mathematics, Dicks seems to be the most negative.[58] While he accepts the view of Thales that can be derived from reports in Herodotus, Plato, Aristotle, and by means of his inclusion on the list of the Seven Wise Men, as an essentially practical man, a sensible politician, clever in business and with an inclination to natural science, Dicks rejects rather the whole testimony of Eudemus on whom we must rely to derive our knowledge of Thales' contribution to mathematics. Dicks's view is that in the absence of any primary evidence for Thales, Eudemus seems to have used him as a peg on which to hang an account of mathematical and astronomical beginnings. Eudemus would have us believe, wrongly in Dicks's view, that Thales was the first to subject a range of empirical knowledge to the rigorous Euclidean type of mathematical reasoning, to have transmitted Egyptian and Babylonian science to Greece, and to have marked the origins of Greek mathematics and astronomy.

Dicks's severe objections have also been met with reasonable criticism.[59] While he cautiously admonishes not to read more into the reports than they say, we do have reports that claim that Thales proved some theorems but the exact method and rigor of these demonstrations are partially clouded by later work. We do have abundant evidence for Greek mathematics in the classical period and this cannot be taken to have emerged *ex nihilo* any more than it can be posited with some scholars at the beginning of this century that Greek philosophy emerged precisely out of a "miracle." Of course, mathematical reasoning and proofs at the beginnings must have been simpler than the rigorous and systematical proofs that we find in Euclid. In keeping with Dicks's assessment that the origins of mathematical enterprises must have begun with the practical needs of people, architecture, engineering, and map-making projects provide ready challenges for a man such as Thales. And Dicks does concede that Thales had a bent for natural science while proving to be an eminently practical man with political sensibilities and an astute quality for conducting business. When the architects ventured into their new monumental projects, as we shall see, a host of new technical problems presented themselves, not all of which were successfully answered on their first try. Perhaps Thales reflected on their problems, or their successes, and like a clever businessman, sought to understand why some techniques—such as the principles of isosceles triangles that were employed in making levelling devices—were better than others, and would prove more reliable in the future, given the extraordinary costs of monumental building.[60] Thus, we should not be surprised to find Eudemus ascribing to Thales the beginnings of Greek mathematics, especially if we consider the simpler nature of the techniques to which he may have appealed in offering his theorems.

What kinds of simpler proofs might Thales have offered? We have already considered, in words and drawings, the kind of proofs with which he is credited, but the technique of "how" he proved them has still not been considered. Von Fritz offered the view that pre-Euclidean proofs relied on the *epharmozein* method.[61] The proof technique consists in demonstrating that things are equal by the practical, hands-on experience of making them fit. Euclid still retains this application in his axioms: Common-Notion #4: "Things which 'coincide' (*epharmozonta*) with one another are equal to one another." The idea is that if one thing fits another exactly, then that is proof they are equal. Heath emphasizes just this point in his commentary on theorems I.4 and I.8; the phraseology leaves no room for doubt that Euclid regarded one figure as actually moved and placed upon the other.[62] It also seems that Euclid disliked the method and avoided it whenever he could. The reason why he retained it, according to Heath, is that "It looks as though he found the method handed down by tradition (we can hardly suppose that, if Thales proved that the diameter of a circle divides it into two equal parts, he would do so by any other method than that of superimposition), and followed it, in the few cases where he does so, only because he had not been able to see his way to a satisfactory substitute."[63] Thus, *contra* Dicks, it seems reasonable to find grounds for the beginnings of mathematical proof in Thales whose procedures were part of the tradition that Euclid both absorbed and eschewed. Another argument that has been proposed to try to persuade us of the veracity of Eudemus's testimony is the peculiar parlance that Thales apparently employed in his demonstration of the isosceles triangle. Thales called the base angles *homoioi*, not *isoi*, as we find in Euclid, and Rankin believes this peculiarity points to an old-fashioned nomenclature.[64] Schmidt construes the difference to be that *homoios* connotes an equality of nature or condition, while *isos* is more concerned with number, quantity, and mass.[65] Furthermore, Proclus, whose authority was Eudemus, mentions a number of proofs that are both ascribed to Thales and not in Euclid[66] and commentators up to and including Heath have reasonably concluded that it is only by means of the *epharmozein* method that he could have done so.[67] Von Fritz concludes that this method must be traceable to the earliest efforts in Greek mathematics, and he suggests that it can hardly be coincidental that of the five theorems that have been credited to Thales, four of them can be proven directly and one indirectly by the *epharmozein* method.[68] Thus, in addition to the established view of Thales as a practical and political man with business savvy, it is reasonable to accept Thales at the beginning of Greek mathematics. Dicks may indeed be right to disassociate Thales from the polished, sophisticated, and rigorous demonstrations that we find in Euclid. But the success of Euclid was not a "miracle"; Thales' contribution belongs plausibly to the early background from which the traditions of geometers and mathematicians developed. Indeed, Dicks seems to know nothing of the *epharmozein* method, a technique that certainly grew out of the empirical and practical techniques that he acknowledges as appropriate for Thales, and that as we can see has correspondences in the architectural tradition. For example, when there was a dispute over the size of a roof tile, the Greeks apparently preferred to resolve it by means of the tile standard located in the agora, and not as given by a verbal description in words and numbers—the *syngraphai*—as was also their habit in making building contracts.[69] Disputes would likely have been settled by superimposition, placing the tile directly on the standard to prove, or disprove, whether the tile in question was equal to it. And a comparable argument can be made for the use the *anagrapheus* at building sites, which we will investigate in chapter 3, where "proof" of equality finds expression in fitting a template over a decorated design.

Anaximander, whose contributions will be taken up in detail in chapter 4, is credited with making the first Greek map of the inhabited earth, inventing a seasonal sundial, introducing the gnomon or set-square,[70] and making the first geometrically ordered model of the cosmos. Thus, among the accomplishments, real or imagined, identified with the names of "Thales" and "Anaximander" are innovations in applied geometry.[71]

The engineer/architect Theodorus, connected to Dipteros I, the first monumental temple to Hera in Samos, is credited with comparable and analogous feats.[72] He, like Anaximander, is credited with inventing or introducing the set-square, as well as the lathe, the rule, and the key.[73] He is recognized for inventing the lathe or somehow transforming the potter's wheel into such a serviceable device in order to produce the extraordinary number of limestone column-drums that were used in the Heraion.[74] He is credited with diverting the river Imbrasus so that he could set the platform for the temple of Hera in the marshy shelving beach in Samos.[75] And he is given credit, along with Rhoikos, for the invention of a new technique for casting life-size statues in bronze; by so doing, they revolutionized the art of sculpture by challenging the stonecutters. The invention of a device for securing a straight line, a construction plumb, perhaps in a form resembling the construction of an isosceles triangle, is also connected with Theodorus. This kinship of interests between Thales and Theodorus, the one who allegedly perfected a proof for an isosceles triangle and the other who made practical use of such an exacting construction for building, together with the credit that both share for diverting rivers, merits some pause.

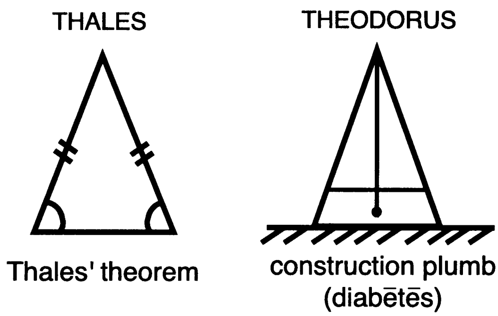



*Figure 2.3*

*Thales' theorem/isosceles triangle and Theodorus's levelling device (diabētēs)*

In an archaic world in which these "professions" were not highly compartmentalized in a fashion after our own, the roles of "engineer," "architect," and "sophos," may have intermingled and overlapped. A likely consequence was the mutual interaction, collaboration, and stimulation of the varying members, the most distinguished of which share the family resemblance of accomplishments in applied geometry.

Chersiphron and Metagenes from Crete are the names of the architects who are associated with the construction of the marble temple of Artemis in Ephesus, one of the seven wonders of the ancient world. Their names, too, are connected with innovations in applied geometry. In both cases, the father and son team are recognized for their clever techniques for moving monoliths. Chersiphron is credited, first, with moving small marble blocks, much heavier than the limestone blocks used in the Theodoros Heraion that pre-dates it by a few years. His son Metagenes gained esteem for applying and extending Chersiphron's technique for the moving of monolithic architraves. Concerned that wagons could not successfully transport the weighty drums for the colossal temple of Artemis, Chersiphron had the idea of fitting pivots in the center of each column-drum and placing them in wooden frames set rectangularly around the stone, encircled as if by a huge wheel. The wheel would be rolled, pulled by oxen, and the result would be that the weight, being distributed more evenly, would be less susceptible to

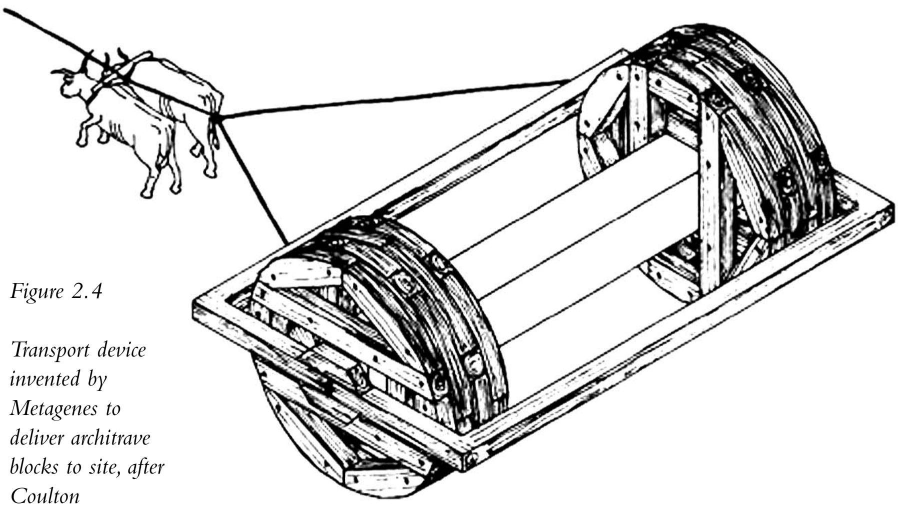


*Figure 2.4*

*Transport device invented by Metagenes to deliver architrave blocks to site, after Coulton* breakdown or becoming encumbered in the marshy soil. Metagenes developed this successful technique for the delivery of architrave blocks. He built wooden wheels twelve feet in diameter and placed them around each end of the architrave so that, like column-drum transportation, the rectangular block could roll. Metagenes reinterpreted the meaning of the architrave to effect this transportation; in it, he saw an axle.

When West discusses Pherecydes' prose book, he reminds us that this medium was not the one by which the early archaic poet communicated with his public. The poet recited, sang, or taught others to sing and thus his public knew of his work, if they knew it at all, from hearing it, not reading it. The written book was a record of the spoken or sung word and more importantly was subordinate to it.[76] Its primary value, West observes, was to the author himself, as an aid to memory, a manner of fixing the fluidity of his thoughts, or even a visible token. West also notes the testimony to books written and then dedicated in the temples as if nothing more was to be done with them;[77] they were *anathemata*. While this analysis may be fitting for Pherecydes what is missing in such a view is an eye to the transitions in role that written books were undergoing. The mid-sixth century may likely serve as a significant point of departure. On the one hand, the Greeks have long traditions for votive dedications at religious sites, and surely the placing of a book in a temple reflects a similar strategy to the placing there of a votive such as a bronze or clay figure. But, on the other hand, the archaic Greeks also had a burgeoning tradition of competition and contests for excellence. The emergence of prose writing must also be seen against this horizon. The archaic Ephesians were worthy competition for the Samians. Not to be outdone by the Samians who built the Dipteros I temple, the Ephesians competed and surpassed them with their marble wonder, Artemision D. So also for worthy competitors from nearby Miletus when they sought to rival the Ephesians and Samians with the temple to Apollo Didymaios. The writers of architectural treatises, like the contestants in the Olympic games, offered exemplars of excellence worthy of a prize. Not a foot race nor a high jump, the architects, nonetheless, produced architectural treatises both to illuminate a special wisdom and to offer as tokens of their awesome productions; so also Anaximander and Heraclitus produced philosophical treatises in prose as testimonies to their excellence and insight.

There was, no doubt, yet another significant, motivating factor for the writing of architectural treatises and this was purely practical. The building of monumental stone temples was new to archaic Greece and appears in Ionia not earlier than the late seventh century. The sociopolitical motivations for temple building increased the demand for the construction of these new temples and the techniques for building were not widely known. The treatises provided guidance for less experienced temple builders, and for house builders now attempting larger edifices made possible by the increasing wealth of their poleis. We must keep in mind that there was a mere handful of able and experienced architects who could be reasonably entrusted to successfully complete these grand projects. Chersiphron and Metagenes came from Knossos on Crete to undertake the Artemision, and just a few years later Eupalinos, the Megarian, was entrusted to build the tunnel/water channel on Samos.[78] It was not possible for the few talented architects experienced in working on very large scales to supervise all the new projects now demanded, and the architectural treatises must surely have helped to serve this practical purpose. More than an *aide memoire* or a visible token, the architectural treatises offered one of the earliest examples of "book learning," and prose became progressively accepted as the appropriate medium for communicating technical details. Thus, architectural treatises promoted rationalizing discourse in prose as their *modus operandi*.

That monumental architecture was *new* to archaic Greece is a curious understatement. In order to better grasp the challenges that the new architects faced, and the new horizon for human ability to understand and control nature which they opened, we must reflect on the loss of earlier architectural knowledge and how the knowledge might have been regained. This will lead us to think again about Egypt's direct and indirect contribution to archaic Greece in matters architectural, and will re-set the context in which Anaximander's innovations represent a meaningful departure. For just as Anaximander's prose treatise offered a new glimpse into nature and the human capacity to understand it, so also did the work of Theodorus and Rhoikos, Chersiphron and Metagenes, and the likely instructional and celebratory record they left in their prose treatises.

## The New Connection: The Contribution of the Egyptian Architects to the Ionian Greek Architects of the Archaic Period

After the fall of Mycenae and for all means and purposes the central palace civilization in Greece, the evidence suggests an enormous depopulation in Greece, measurable in part by grave records and most substantially by the diminutive size and extremely limited number of settlements.[79] From roughly 1100–900 BCE, the so-called Dark Age, tribal systems—the *ethnos*—became dominant where the central palace, now fallen, had flourished. In settlements numbering in the hundreds rather than the thousands, the structure of social life was considerably different than it had been. Every member of the community is integral when the total numbers are few, and the death of even a single member means an increase in hardships for the whole community.[80] There is neither time nor means to undertake monumental building projects when the small community is focused exclusively on subsistence. But, as Thucydides tells us, the population perhaps quadrupled in the span of the tenth and ninth centuries. The rapidly growing population produced new social challenges; one new strategy to meet the demands for land and resources was colonization.[81] The Greeks who lived on the mainland in close proximity to the sea were disinclined to search for land and resources in the difficult mountainous terrain of the Greek hinterland. Instead, many set sail for the eastern islands such as Samos and most especially the west coast of Asia Minor, present-day Turkey, to establish colonies in Miletus, Ephesus, and at other locations up and down the coast where the geography closely resembled the Greek mainland and the large open and fertile plains could support enormous populations.[82]

At the same time, for perhaps the ten generations or more since the fall of the Mycenaean central palace—grave records in the form of skeletal remains attest to life spans averaging thirty years—there seems to have been no truly monumental construction in the Greek world.[83] The techniques known to those who built the Lions Gate in Mycenae, for example, were long since lost. On the eastern Greek islands, such as Samos, there were no monumental constructions that could even have served as exemplars for re-devising comparable construction techniques.[84]

A chorus of ancient and modern writers sing in unison that the inspiration for the design and construction details of the archaic Greek temples is to be derived from the land of the Pharaohs. "The ultimate inspiration was probably to be sought in the multi-columned temples of Egypt."[85] In the seventh century BCE the relations between the Ionians and Pharaoh Psamtik[86] had become close. Indeed Psamtik, forced into exile, relied heavily on the help of mercenaries from Ionia to regain Pharaonic control. This we learn from Herodotus and there is no reason to doubt it.[87] Further confirmation comes from Pliny who, like Herodotus, speaks of the Samian Heraion as the "Labyrinth"; both writers claimed the Heraion was inspired by an Egyptian temple at Lake Moeris, but precisely which one they had in mind is still not certain.[88]

The answer, then, to the question of where the archaic Greeks, especially of Ionia, derived their architectural knowledge as well as their inspiration for building their multi-columned temples of extraordinary size, is Egypt. While the Ionians lived in Egypt and fought on behalf of Pharaoh Psamtik they would have had the opportunity to see many monumental constructions, many multicolumned temples, and most importantly could have and would have been able to learn from the Egyptian architects involved in ongoing projects just how the monumental edifices were planned and erected. The Egyptians of the twenty-sixth dynasty stood at the outermost edge of *continuous* architectural traditions spanning more than two millennia; they were in a position to inspire and educate the Ionian Greeks who were disengaged from their own architectural ancestors by more than four hundred years. And under the restored Pharaoh Psamtik, the Egyptians owed them considerable debt. Indeed, the Milesians, unique among the Greeks, were allowed to found a trading post in the Nile Delta which became the thriving city of Naucratis. And Naucratis was the principal link between Egypt and Ionia. At just this time, Milesian sea power was a dominant force in the eastern Mediterranean, so much so that when Pharaoh Neco II succeeded his father Psamtik, he ordered the creation of a navy and had it built and manned by Milesians and other Ionians.[89] And it was this same pharaoh who ordered the building of a canal to connect the Nile with the Red Sea. Although the canal was not completed until Persian Darius finished it about 520 BCE, the ongoing project would have enabled the architect Theodorus or the *phusiologos* Thales to learn firsthand the techniques of moving bodies of water, that is, diverting the rivers with which both are credited.

How much Egyptian temple architecture could have been seen by the Greeks can be reckoned by appeal to the very fact of Greek inscriptions cut into the legs of the colossal statues at Abu Simbel. We know from Herodotus that Pharaoh Psamtik II, the successor of Neco II, made an expedition to Nubia, c. 591 BCE, to deal with threats from Upper Egypt, and that Greek mercenaries accompanied him.[90] The inscriptions prove that the Greeks had travelled in this campaign as far as Abu Simbel, some seven hundred miles up the Nile.[91] In the Delta, there were multicolumned temples to serve as inspiration, and as the Greeks sailed south they would have seen, rising majestically from the landscape and hugging the Nile, a vast array of monumental architecture, including, most importantly, the multicolumned temples at Karnak and Luxor. But the Greeks sailing from Lower Egypt would also have seen the Great Pyramids on the Giza plateau, the Dhashur pyramids, the ones at Abusir and Sakkara, and at Meidum, Hawara, and el-Lahun. As they made their way further south, additional monumental architecture and multicolumned temples lined their route to Abu Simbel, especially the ones at Abydos. The startling sight of these megaliths rise up from the landscape, no doubt, left a lasting impression on the Greeks who chose also to build their temples close to the water. Here was the inspiration to build multicolumned temples in monumental proportions; here were ongoing building projects from which the Greeks could have learned how to erect them.

Even if the Greeks had wanted to build monumentally before they found themselves on the banks of the Nile they would have lacked the technical know-how for quarrying, transporting, and installing megalithic masonry. It is plausible that Egyptian technology served as a primary player in the reemergence of monumental architecture in archaic Ionia. This is not to say that the Ionian Greeks simply copied Egyptian temples. Indeed, quite to the contrary, the evidence suggests that the Ionian Greeks created structures that were unique, and the evidence for this will be taken up later. For now, the main point is that the Egyptian techniques for monumental construction and the exemplars they had produced stimulated the Ionian Greeks. And that from Naucratis where they had a thriving colony, no more than a weekend's travel away, the Ionians had extraordinary access to a grateful Egypt.

## An Overview of Monumental Temple Projects in Archaic Ionia

In the late seventh or early sixth centuries BCE, huge stone temples were built to Apollo in Didyma, Artemis in Ephesus, and Hera in Samos. New excavations have complicated the precise sequence of monumental stone architecture in Ionia.[92] We know that there were monumental temples, built primarily of local limestone and poros, dedicated to Artemis in Ephesus and Apollo Didymaios, already at the end of the seventh or earliest part of the sixth century BCE.[93] The first monumental temple made completely of stone and dedicated to Hera in Samos—Dipteros I—began in the first quarter of the sixth century.[94] But how shall we understand the Hellenic architectural developments that commingled with the input of architectural ideals and techniques from Egypt and elsewhere?

Snodgrass offers us the archaeological record of dedications in bronze, especially at Phlia (Thessaly), Perachora, the Argive Heraion, and Lindos (Rhodes), from the eleventh through the seventh centuries BCE in order to describe and characterize the oriental influence.[95] The oriental influences upon which he focuses are not specifically connected to the temple building itself but rather to the increased interest and participation in rituals associated with the cult practices, principally in the dedicatory offerings. The excavations present the astonishing record of the re-emergence of techniques in metallurgy and metal working attributable to renewed contact of Greece with its neighbors. Where there were no bronze pins, fibulae, or tripods in the eleventh century at these sites, there appear few in the ninth century, and then stunning numbers in the eighth and seventh centuries. In Phlia, there were no signs of bronze fibulae in the later eleventh and tenth centuries, two in the ninth and eighth centuries, and then more than 1,700 fibulae in the later eighth and seventh. At the Argive Heraion, dedicatory bronze pins increase from three to 250, and then to more than 3,000 in the later eighth and seventh centuries. Just as the evidence dramatically suggests an influx of orientalizing influence in the ninth and eighth centuries, according to Snodgrass, so also the tutoring in building skills, quarrying, and planning came along with it from outside. This, of course, does not mean that the designs were fully embraced, nor that the function of the buildings mirrored the use of their neighbors.

While the renewed inspirations came from Egypt and the Near East the developments were peculiarly of a Greek type. The evidence suggests that the specific developments of monumental architecture in Didyma, Samos, and Ephesus were indigenous, that is, the building details and their specific functions found expression in those design features in an original fashion. That originality reflected the unique combination of religious, political, and social ingredients native to Ionia. We now turn to those indigenous developments.

According to Kienast's recent excavation,[96] pottery dating to c. 575 BCE was discovered under the foundation of Dipteros I.[97] This suggests that, shortly thereafter, the construction of the monumental stone temple to Hera began in Samos. The building site was roughly the same as that for the eighth and seventh-century house, when steps were taken in progressive stages first to elongate and then to widen the house made of timbers, but the new plan was much, much bigger. Consider the illustration below, after Buschor, that shows the layout of the Heraion sanctuary and comparative sizes of the construction. The first temples, known as *Hekatompedons* or "hundred-footers," were constructed out of wood and mud brick, and the columns were made of large trees. Subsequently, Dipteros I, and then Dipteros II (c. 540) were constructed.[98]

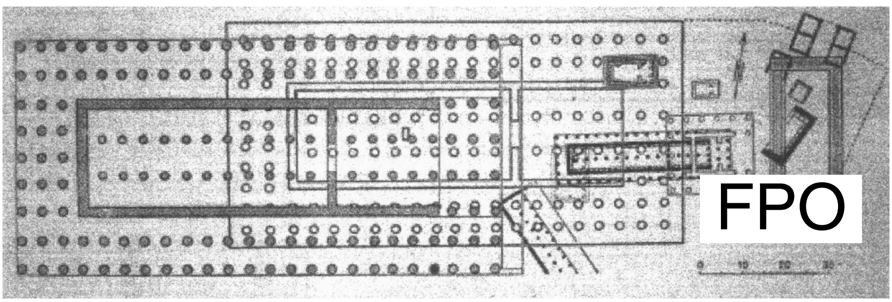



*Figure 2.5*

*The Heraion of Samos, overlapping historical development*

In the development of temple building in archaic Samos, it was not the elongation of the house of the goddess that required a transition to stone architecture, but rather the widening of the *naos* or cella. When the decision was made to widen the house to achieve a greater monumentality as was befitting the goddess and her thriving community, the available timber was insufficient to carry the weight of the enlarged tiled roof.[99] When plans were made for the Dipteros I, the architects had to think out beforehand elaborate details of a structure more immense than anything they had ever undertaken and with a material that they had never used so extensively. The immense temple had to be constructed of stone; one of the first technical problems that had to be solved was how to set the platform for so massive a building when the surface ground was itself a marsh.[100] How could the foundation carry so great a load? Before this important problem could have a solution, another related difficulty had to be solved first, namely, the source of the extremely marshy conditions. The river Imbrasus flooded the marsh periodically; during a particularly great flood, an earlier wooden temple had collapsed. So, Theodorus set out to divert the river Imbrasus prior to setting the platform.[101] This engineering feat plausibly achieved two goals. First, it made more unlikely the devastation due to flooding that had plagued earlier constructions. Second, it diminished the quantity of natural ground water in the marshy area in which the lygos tree grew; this would be necessary for setting the huge platform with sufficient stability to carry the immense load that was to be erected upon it. Hera was a fertility goddess and so the choice of swampy land from which, as the water recedes, life springs forth, was particularly appropriate for her house. Like Thales, who believed that *hudor* or water was the ultimate stuff from which all things derive,[102] so also the cult of Hera found common ground, so to speak, in a marshy source from which a special force of life emerges. But, however appropriate was the marshy land as the sacred precinct of Hera, the difficulties of building there were very great.

Theodorus's project of diverting the river Imbrasus for Dipteros I was a feat of applied geometry, just as was the project undertaken by Thales to divert the river Halys for Kroisos's army.[103] And both techniques could have benefited from a visit to the Egyptian site of the canal project underway at the orders of Neco II attempting to connect the Nile to the Red Sea, or from discussions with those who had visited the ongoing construction. Since Kroisos came to power not earlier than c. 560 BCE, and since the temple construction in Samos began soon after c. 575 BCE, a construction that some excavators believe could not proceed past the most rudimentary details without redirecting the river, we have good reason to believe that the credit for diverting an Ionian river belongs earlier to the architects than to Thales. Indeed, it seems so likely that, notwithstanding the ongoing project in Egypt of which the Ionians were certainly aware, Theodorus's project might have supplied the technique, or its at least its confirmation, to Thales, either directly through discussions or indirectly from those who witnessed the engineering feat itself.

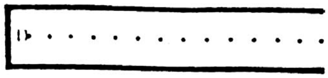
The need for reclaimed land at the site sacred to Hera was indispensable for setting the platform.[104] The position of the temple was determined by the altar—the most important and oldest part of the sanctuary—which without moving its location was rebuilt on a much grander scale. The resulting temple was more than three times the size of its predecessor, measuring roughly 172.2 feet by 344.4 feet.[105] There was no temple anywhere in the Greek world of comparable size. The colonnade for the Dipteros I temple[106] was set back from the top step about ten feet, and there were eight columns on the front facade. The dipteral construction, that is the double peristyle to each side of the cella, accounted for the substantial enlargement. Having replaced the wooden columns of the earlier constructions with stone columns, the resulting experience upon entering the temple must have been like walking through a petrified forest. This is not to say that people frequently, if ever, entered the house of the goddess. Rather, the cult activity ordinarily took place outside of the house, at the altar directly in front of the temple porch. The sacrifices were to be visible, when the double doors were opened, to the cult statue seated inside—the earliest of which was a plank of wood, no doubt from the sacred lygos tree. At the site of the huge altar, the sacrificial animal would have had its throat cut and the carefully collected blood would have been splattered on the altar; the animal's body would have been ritually dismembered and burned, and the smoke billowing upward, like that from a local barbecue, would attract the deity who, although living on high, would come down to the altar, and so be drawn close.[107] Thus, the house of the goddess was not to be inhabited by mortals and yet its design and awesome proportions were intended to overwhelm and impress the visitor to the sanctuary; the temple design was an expression that the archaic community came to regard as appropriate to honor the highest and best. In this sense, by means of the house-building tradition, patronized by the archaic aristocrats, the ruling class externalized their internal vision of *kalos kai agathos*, the most beautiful and best in their community. Stated differently, they sought to externalize themselves and further secure respect and authority at a time when the challenges to authority and control of land were on the increase. In the process, the aristocratic plan was to enhance their rightful authority; they sought to reinforce their dominant position by externalizing the vision of the highest and best by overwhelming their communities through patronage of monumental proportions and sought to align themselves with the best and most powerful forces in nature. And no one should doubt that the development of the sanctuary provided a social vehicle by which the disparate elements in the thriving city could be organized cohesively.[108]

Let us consider these chronological transitions in temple construction, side by side, in order to better grasp the magnitude of the sixth-century project (figure 2.6).

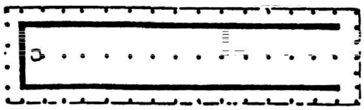
In the early stages of construction, having set the platform and engineered the stylobate, important tasks confronting Theodorus included quarrying, transporting, and installing the columns that constituted the petrified forest.[109] Theodorus, plausibly, found the inspiration for employing column-drums, instead of monolithic columns, in Egypt, where this construction

*Figure 2.6*

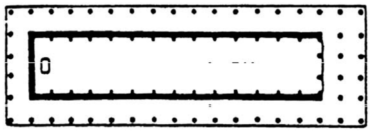
*The Heraion of Samos, sequential view*



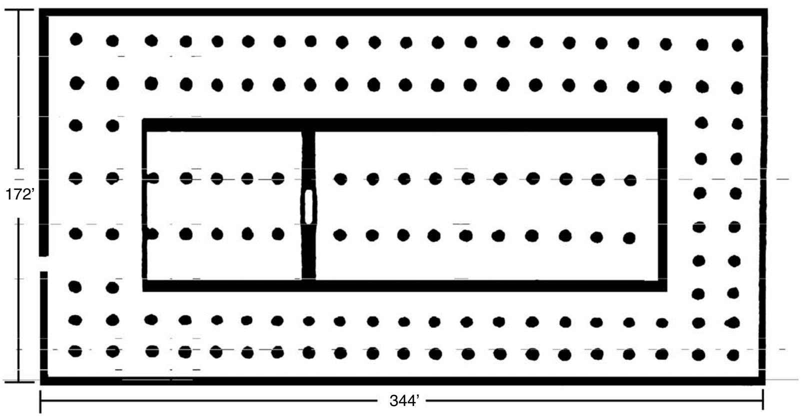
Hekatompedon I: early 8th century BCE (Samos)



Hekatompedon Ia: c. 700 BCE (Samos)



Hekatompedon II: mid 7th century BCE (Samos)




Theodorus Temple: c. 575 BCE (Samos)
Plan after Kyrieleis

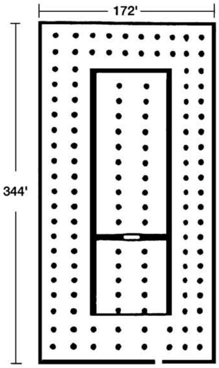
technique was necessary because of the gigantic proportions involved and because of the near impossibility of delivering so many monolithic columns to the sites.[110] But Theodorus’s work was both easier and more complicated by the choice of using local limestone instead of marble, imported sandstone or granite. Pliny says there were one hundred fifty columns. Each column was constituted by drums, perhaps ten or more per column. Even if Pliny is mistaken in his estimation of the total number of columns,[111] the construction certainly called for more than a thousand drums. The invention of a lathe for turning out these drums is credited to Theodorus. Pliny says of this invention that "the drums were so well hung in the workshop that a child was able to turn them on the lathe."[112] Judging by the remaining column bases from Dipteros I, we can say with certainty that use was made of a lathe.[113]

The introduction of column-drums was entirely new in archaic Greece and in Ionia in the late seventh or early sixth centuries. The invention and construction of a lathe, and the engineering ingenuity for diverting a river to reclaim land for the construction, were perhaps described in the architectural treatise that set out the canon of proportions written by Theodorus, although these details must remain a conjecture.[114] Indeed, what seems compelling is that when the construction began, almost directly across from Samos, in Ephesus around 560 BCE, the architects, finding themselves in the same flooded, marshy landscape sacred to another fertility goddess, Artemis, enlisted the assistance of Theodorus when the first attempt to build the temple resulted in disaster.[115] It may have struck Theodorus that, on the one hand, there were many admirers and devotees of fertility cults, the houses for whose deities would require comparable techniques for building on marshy land, and on the other, he could not possibly visit all of these construction sites. Thus, perhaps an excursion to nearby Ephesus not long after 560 convinced him to write a prose treatise, both to share the insights he perfected with other would-be builders, and to bring renown to his own genius and achievements.[116] It is for these sorts of reasons that the motivation for writing a prose treatise came to represent a means for sharing ideas and claiming victory in monumental achievement rather than simply as an *aide memoire*, a means of fixing fluid thoughts, or even as a visible token. And the problem-solving techniques of the architects fostered rationalizing, not mythologizing, discourse.

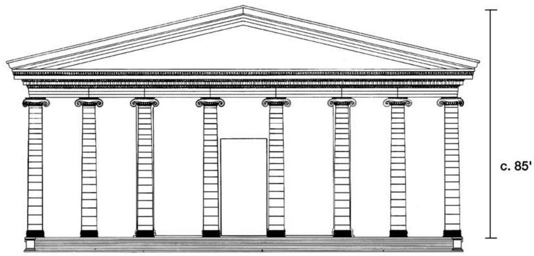
The prose treatises of Chersiphron and Metagenes might have overlapped, in part, with that by Theodorus but also would likely have contained new ingredients. This was a consequence of their building an even larger temple out of harder and heavier marble and to a greater height. The dimensions of the Artemision were even greater than those of the Heraion though the overall gestalt was just like it—twice as long as wide, and twice as wide as high. The temple platform was both wider and longer. It measured roughly 180.9 feet by 377.4 feet.[117] According to Pliny, there were 127 columns that reached a height of approximately 60 feet.[118] In order to make clearer still the similarity in overall design of the archaic Heraion and Artemision, and at the same time to emphasize the extraordinary difference in appearance of plan or aerial view, as opposed to an elevation, both temple designs are presented on the following page (figure 2.7).

As mentioned earlier, Chersiphron and Metagenes were faced with the task of moving the heavier marble stone, and their huge construction required a great quantity of it. It is a reasonable conjecture that their prose treatise would have included instructions for making the devices for transporting these huge monoliths,[119] for Vitruvius seems to be referring to just these devices when he mentions their efforts.

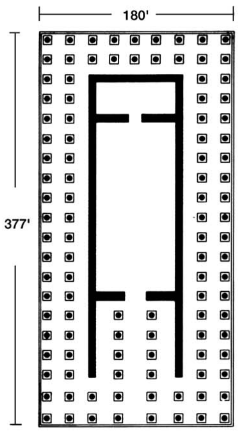
The problem of installing the monolithic architraves deserves some further consideration. The architects were confronted by great challenges that appealed to techniques in applied geometry and engineering for their creative solutions. These problems were of a piece with the challenge of measuring the height of a pyramid or the distance of a ship at sea,[120] a challenge undertaken by Thales. In fact, such reflections on geometrical and engineering techniques help us to see better the architects as engaging in the rudimentary stages of an experimental science, the success of which consists minimally in the building standing tall and not collapsing under its own weight, and maximally by achieving aesthetic and religious-ritualistic excellence once the structural problems had been resolved. Both Vitruvius and Pliny refer to the difficulties that the architects had in lifting into place the massive architrave blocks. According to one source the weight of the central block has been judged to be not less than 48,000 pounds and perhaps as much as 80,000 pounds; it had to be dragged up a ramp some sixty feet off the ground and levered into place.[121] Pliny describes the difficulty and its solution in a remarkable story:[122]



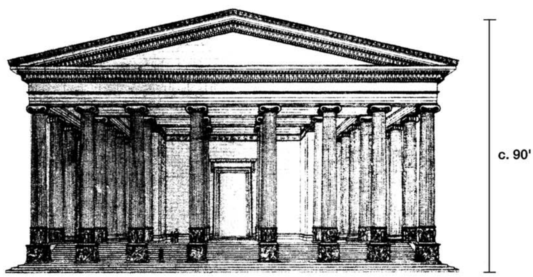

**Plan**
**Temple of Hera**
**(after Kyrieleis)**




**Elevation**
**Possible Reconstruction**
**of the Theodorus (Dipteros I)**
**Temple of Hera c. 575 BCE**
**(after Tomlinson)**




**Plan**
**Temple of Artemis at Ephesus**
**(after Tomlinson)**




**Elevation**
**Archaic Temple of Artemis at Ephesus**
**(after Grant)**

*Figure 2.7*

*Plan vs. Elevation views, Temple of Hera/Samos and Temple of Artemis/Ephesus*

> The architect in charge of the work was Chersiphron. The crowning marvel was his success in lifting the architraves of this massive building into place. This he achieved by filling bags of plaited reeds with sand and constructing a gently graded ramp which reached the upper surfaces of the capitals of the columns. Then, little by little, he emptied the lowest layer of bags, so that the fabric gradually settled into its right position. But the greatest difficulty was encountered with the lintel itself when he was trying to place it over the door; for this was the largest block and it would not settle on its bed. The architect was in anguish as he debated whether suicide should be his final decision. The story goes that in the course of his reflections he became weary, and that while he slept at night he saw before him the goddess for whom the temple was built: she was urging him to live because, as she said, she herself had laid the stone. And on the next day this was seen to be the case. The stone appeared to have been adjusted merely by dint of its own weight.

The dating for the early stages of construction of the Samian Dipteros I and the marble Ephesian Artemision D are easier to establish, however, than the probable dates for the publications of the architects' prose treatises that would likely have detailed the planning, proportions, and methods that led to those achievements. We know that the Artemision had eight columns across the front facade and probably twenty-one along each side. The columns in front had special, high bases, carved with figure scenes in relief. There are inscriptions on the bases indicating that they had been dedicated by Kroisos.[123] Now, Kroisos, king of Lydia, was defeated by Cyrus, king of Persia, in 546 BCE when Kroisos entered battle, according to legend, on a misleading Delphic prophecy. Thus, the construction had to be well along by 546 in order to account for these ornately carved drums. Since Kroisos came to power in c. 560, and since he was a principal donor of the new temple, it is unlikely that much progress would have been underway earlier.[124]

Scholars have been tempted to date the Dipteros I to be earlier than the Ephesian Artemision D by a decade or two and this now seems to be even more certain to be correct. The collaboration of Theodorus with Chersiphron and Metagenes could be taken to lend further support to such a chronological view. It is tempting to suppose that soon after Theodorus consulted in Ephesus about the problem of building in the marshy soil, he decided to write a prose treatise both for other architects who found themselves in the same difficulties that confronted Chersiphron and, of course, to gain a measure of personal glory. Just as the Ephesians rivaled Samos in building great stone temples, so also not to be outdone, architects Chersiphron and Metagenes followed Theodorus with their own prose treatises, perhaps dedicated in the very temples that they built. For such reasons, it is tempting to make the conjecture that Theodorus wrote and made public his prose treatise not long after 560 BCE and possibly earlier, that is, in any case not long after consulting in Ephesus. Chersiphron and Metagenes, in the same spirit of rivalry, wrote and made public their prose treatises shortly thereafter, perhaps closer to 550 BCE. Certainly by this time the architects in Ephesus had perfected their techniques for moving and installing monolithic marble.

If the reader will entertain these hypotheses for the moment then Anaximander's prose book and publication in 548–547 BCE emerges in a newly illuminated context. The agglomeration of the social roles of engineer, architect, *sophos*, and philosopher belong in the minds of sixth and certainly fifth-century Greeks to the same general social anomaly of practical geniuses, as Aristophanes' *Birds* proves,[125] and the litany of achievements, real or imagined, was found entirely believable by them. Thales predicted a solar eclipse, measured the height of a pyramid, measured the distance of a ship at sea, was the first to import geometry from Egypt, and provided proofs for several theorems (especially the one for the isosceles triangle that was arguably a reflection on the architect's construction plumb). Thales urged the Ionians to federate in the face of the Persian threat, and proved to be clever in business by making a meteorological prediction that was the basis of his buying out the olive presses and renting them out at a neat profit after great rains produced a bumper crop; he introduced a new technique for celestial navigation, and he is credited with diverting the river Halys for Kroisos—a feat all the more miraculous since Thales must have been more than seventy years old when he did it. Anaximander wrote the first philosophical book in prose, invented or introduced the gnomon, made the first seasonal sundial, made the first Greek map of the inhabited world, made a geometrical model of the cosmos, founded a colony (perhaps on the Black Sea), and invented a theory of biological evolution. Theodorus wrote the first architectural book in prose; together with Rhoikos, he is credited with inventing or introducing the line, rule, lathe, lever, and the key; they invented a method for modelling in clay and casting life-size bronze statues, perfected a technique for making miniature bronzes, diverted the river Imbrasus to set the platform for the great temple of Hera, made a silver bowl for Kroisos, made an emerald ring for Polycrates. Theodorus and Rhoikos are credited with making the Pythian Apollo at Samos, the Samian Heraion, the Scias at Sparta, and bringing back from Egypt the canon of proportions for the human figure. Chersiphron and Metagenes are credited with the writing of an architectural book in prose, the construction of one of the seven wonders of the ancient world—the Ephesian Artemision, introducing techniques and technologies for moving super-heavy monolithic blocks and architraves and special techniques for fitting them in place. To review a list of these accomplishments, real or imagined, is to face squarely individuals who share a family resemblance. They are all polymaths and share distinctions in feats of applied geometry. The scholarly literature has not come to appreciate properly the unexpected commingling of these persons as part of the same general group of shared interests, and perhaps collaboration.

But there is a deeper point here that lies at the crux of our effort to understand Thales, Anaximander, and the archaic architects, and thus the origins of philosophy; this, in part, rests on distinguishing between what seemed important to the Greeks as opposed to what seems important to us about the Greeks. On the one hand, our scholarly community has expressed many doubts about the list of accomplishments attributed to Thales and Anaximander, and on the other, almost no one has seriously entertained the possible interconnection that they may have had with the architects. Why this is so requires some reflection.[126] Ancient Greek society respected and expected plural excellence. Aeschylus is held up for esteem not only for the excellence he achieved in drama but also for his military prowess. Solon was not only a distinguished lawgiver but also a distinguished poet. Democritus excelled in geometry and also in political theory. Further, the list of names to come down to us as the seven sages includes polymaths of just this sort, and the name of Thales appears on every list; plural excellence was the mark of the highest human attainment, as rare as it might in fact have been.

By contrast, our culture comes to view the polymath not merely as unusual but also suspect. Anyone who claims to be distinguished in several fields runs the risk of being regarded as a charlatan by the leaders in each of those respective fields. We applaud single excellence, and if one takes on more than one special field, one runs great risks; it's better to declare one specialty and to identify all the rest as "hobbies." In the study of ancient Greece, the classicist is suspicious of the philosopher, and to a great extent vice versa. The architect tends to doubt that a philosopher can know very much about architecture; the classicist suspects the architect does not know the literature and history well enough, and so on. And when any of these ancient Greek specialists tries to bring into the discussion Egypt, the Near East, or Sanskrit India, there is a natural disposition toward incredulity.

To want Thales and Anaximander as our first philosophers, the argument goes, we do not want them to do anything else. Thus, Thales' purported achievements in astronomy are referred to Hipparchus, geometry to Euclid, the politics to Solon, and the one most often retold story that is decreed to remain is the one of abstract thinking—college professor—Thales, so lost in his watching the stars, not paying attention to the ground upon which he was walking, that he fell into a pit. When the litany of achievements is recited, the scholar tends to dismiss such a list by insisting that no one person could do all these things. As Greene put it, "In fact, Thales probably did do all the different things for which he is famous. That he did so only appears implausible if one insists on thinking of them as 'all sorts of different things' that one person is unlikely to have mastered, and a person called a 'philosopher' would be especially unlikely to master."[127] The same can be said for Anaximander, Theodorus and Rhoikos, Chersiphron and Metagenes. They are all practical men with broad interests and competence in matters pertaining to applied geometry.[128]

The second issue is to see why modern scholarship has neglected the possible connection between architects and philosophers. The neglect plausibly stems from the first-tier approach to Greek philosophy. The works of Plato and Aristotle, and the tradition of Christian commentators who tried to illuminate the central contribution from that tradition to their own, have lent themselves to diminish the importance of *technē* in the light of reason; the mind, not the body, is the abode of philosophical knowledge. The commonplace is that only by transcending the senses can the mind grasp true knowledge, what *is* as opposed to that which comes and goes; the practitioner of *technē* is relegated in Book X of the *Republic* to the infelicitous role of being thrice removed from reality merely representing a representation of the ultimately real object.[129] How could those involved in *technē* promote the origins of philosophy? Whatever role *technē* contributed to the work of Plato and Aristotle is a different issue, however, from the problem of determining what contribution it made to the earliest episodes in that tradition. The role of *technē* is a formidable factor in any second-tier approach, that is, an approach that seeks an understanding of the rise of a natural, not mythical, explanation of the world.

In this chapter, the discussion has moved from the first-tier to the second-tier, in the hopes of opening a new third-tier, the explanatory horizon of those engaged in projects of applied geometry: Thales, Anaximander, and the community of architects. In order to illuminate farther the cultural context, the sociopolitical factors that drove temple building and so brought the architects onto center stage so that they could stimulate the Milesian *phusiologoi*, we must wait for the final chapter. Now we must first detail the techniques of the architects, and then techniques that Anaximander brought into his own philosophical ruminations, which he might plausibly have learned from them.

The new third tier of background and horizon that we began to explore in this chapter helps us to see in archaic Ionia an ongoing enterprise both scientific and rational that transformed their community. The architects were engaged in bold tasks each of which displayed an experimental character; the success of these tasks was made possible through trial and error, and by means of a premium they placed on *rational* explanation to arrive at their *practical* solutions. The architects had to revise and modify their construction strategies as their immense projects proceeded. Once the fundamental stability of the structure was assured—and this was no easy matter; we know of great failures in the process—the problems of realizing their designs fully occupied their attention. Monumental architecture, unlike many other large projects, always starts from the bottom; the ground level must be established, of course, before the next level can be built upon it. Mistakes made at an earlier stage cannot be rectified easily later on, and the infelicitous results can be financially ruinous. The architects, through their labors visible to the whole community, were displaying principles of nature through the employment of their *technē*; by means of their hands-on experience, tested by trial and error, new practical techniques for quarrying, delivering, installing, and finishing large block masonry were introduced and improved. The architects illustrated in exceptional detail that nature had a definite and determinate structure, and that mortals were indeed able to come to know it and control it. The architects, then, contributed to a transformation in the public mentality, whether they intended to or not, so that the community became increasingly ready to listen to and support those such as Anaximander, the Eleatics, the Atomists, Sophists, the students at the Academy and the Lyceum, who offered to explain nature's structure.

A rational mentality was the key to the architect's success, as their practical solutions illustrate; this rational mentality was surely central to discussions in their precincts as the constructions proceeded. Should a foundation collapse, a wall cave in, a wagon bearing a great load become encumbered in the marshy soil, the architect customarily sought a practical explanation and practical solution in the world of physical law so far as he could understand it, not the world of mythopoiesis. In this important sense, the architects must be seen as promoters of rational discourse in their Ionic communities; that discourse, moreover, prepared the community to be receptive to other kinds of naturalistic explanations. The architect's success, of course, was measured, first of all, by the stability of the finished building. But, these architects were not simply constructing ordinary houses but temples—divine houses. The architects produced earthly structures of cosmic visions, they made houses that reached to the heavens from sacred locations; thus, the architects made the cosmic house, and in their prose books described how the divine houses should be made. In contradistinction, Anaximander in his prose book described our house that is the cosmos, and the stages by which the cosmos was itself constructed—a kind of cosmic architectural history. The argument of chapter 4 is that he imagined this cosmic architecture from both plan and three-dimensional views, and the source of this methodology is, plausibly, none other than the architects, either directly through conversations or indirectly through reflections as they worked on their productions.

However, before moving on to examine in detail the relevant techniques of the architects, we first reflect upon the hypotheses that have been advanced for the cosmic and symbolic significance of the temple in general and the column in particular. This cultural context informs the background in terms of which the Ionians lived and Anaximander's thought unfolded.

## The Meaning of the Temple: Design Choices

The generally accepted thesis about the meaning of the temple is that it provided for social consolidation.[130] The more specific interpretation that it made possible the consolidation of the authority of the polis over its citizens[131] requires a clarification. For the rise of the "polis" is not coextensive with "participatory democracy." The flourishing of the polis meant, first of all, the transformation of the older ethnos system; only later did the polis become increasingly identified with widely democratic reforms. It certainly seems true that authority was wrestled from the traditional ethnos or tribal system and placed in a larger and more divergent social organization throughout the archaic period, as the polis developed. But many poleis went through transitional periods of tyranny on their way to democratic and egalitarian reform. Hence, the feature of participatory government, so crucial to the first-tier approaches to Greek philosophy, that emphasize the role of the polis, was apparently not present in archaic Miletus and Samos, for instance, as it was elsewhere and later throughout the Greek world. While participatory government and other democratic practices of the polis, as we argued earlier,[132] certainly seemed to have had a significant effect on the development of Greek philosophy (first-tier approach), it did not have so central a contributing role in the earliest chapters (second-tier approach) traceable to Ionia where tyrannies, not democracies, prevailed in the sixth century BCE. Thus, we can accept the assessment that the temple made possible the consolidation of the authority of the polis over its population so long as we keep in mind that the "polis" need not refer to the institutionalization of widely democratic practices but rather the newly emerging and integrative social organization.

How was this social consolidation effected by means of the temple? This important and far-reaching question will be approached in chapter 5. For now, we will focus upon the specific design choices, as opposed to structural choices, that were consciously produced in order to convey the meaning of the temple.

We have already explored the plausibility of the idea that the inspiration and techniques for building multicolumned stone temples were imported from Egypt, and also that the specific development of temple architecture proved to be indigenous, that is, developed along original Greek lines. But now we turn to investigate the archaic temple by focusing on its peculiar design structures and the meaning that these choices may have conveyed, intentionally or unintentionally. Scholars have offered hypotheses about the symbolism of the temple column, and its interpretation has broad implications for our understanding of the whole temple in its cultural context. These hypotheses deserve our consideration and reflection:

(1) The column has cosmic significance; it symbolically separates, joins, or interpenetrates the cosmos as its axis;[133]

(2) the columns have a political significance; they are fashioned in human proportions and represent citizens who stand in uniform distances from the center of the house of the god just as they ought to stand from the center of power in the just polis;[134]

(3) the columns had a nautical significance symbolically reflecting the seafaring journey of the colonizers from the mainland to Ionia; the dipteral colonnades around the *naos*,[135] unique to Ionia, are like a double row of oars propelling a ship (*naus*), and the *harmonia* of the well-made city is celebrated analogously with the *harmonia* of a well-made ship;[136]

(4) the columns, understood in a series in connection with the architrave forming a trabeated architecture, represent the upright loom; the temple like the loom is that central device by which the city weaves its socially consolidated fabric;[137]

(5) the column has a peculiarly ritualistic meaning; reflecting the primacy of sacrifice, the column is symbolic of the sacrificial animal with its "foot," its "throat," and its "capital or head."[138]

First, the column had a symbolic meaning for the ancient Greeks. For Homer[139] and Hesiod[140] the column separated heaven from earth, and for Pindar[141] it connected heaven and earth. According to Plato,[142] who allows a Pythagorean to recount the transmigratory Myth of Er, an axis that ran through the entire cosmos around which the heavenly bodies whirled was imagined as a column. And, of course, Anaximander[143] identified the column-drum with the shape of the earth. This symbolic role, then, envisages the column as divider, joiner, or interpenetrator of the heavenly and earthly domains of the cosmos, or even the central axis of the entire cosmos. This ancient evidence proves without a doubt that the column had both a symbolic and cosmic meaning to them.

Second, there is a view that the columns have a political meaning. First of all, they are made in accordance with human proportions. According to Vitruvius, the builders of early mainland temples sought to make load-bearing columns for them. With the memory of the columns that they had seen in Achaea they named these columns Doric because they had first seen them in Dorian cities. Lacking a knowledge of the specific proportions, they made their own by measuring a man's foot-length, determining that it was one-sixth of his height. They thus applied these proportions to produce their columns.[144] In Ionia, however, Vitruvius informs us that for aesthetic reasons their consciously chosen model was the female, not the male form. They made the diameter of the column one-eighth the height, and put a sandal at the base, volutes in the form of curling hair right and left, and fluted the column to suggest the folds of matronly robes.[145] By Vitruvius's testimony, we have reason to understand that the column's proportions drew an analogy to the human form.

Once one grants the connection of columns with people, the structural organization of the temple becomes decisive for this interpretation. While in early eighth-century temples, such as the Samian Heraion, the columns made of trees were placed inside the *naos* where the cult statue stood, the development shows that the columns were moved outside to support the roof structure as the temple was enlarged. When the columns were moved outside, the focus of the power of the temple became conspicuously located *es meson* with the cult statue and hearth. And so, it has been argued, in the first peripteral temples, the people stand in *isonomia* around the power located *es meson*,[146] as they ought to stand in the just polis. In precisely this sense, according to Herodotus, Maeandrius, the successor to Polycrates, the sixth-century BCE tyrant on Samos, declared that "I never approved . . . of Polycrates reigning as despot over men who were his equals. . . . For myself, I lay down the *es meson tēn archēn* and I proclaim *isonomia* for you."[147] This interpretation of the temple colonnade can be viewed as utopian, an expression of how things ought to be in the just society, since this is how each person properly deserves to stand before the divine and ultimate authority.

Third and fourth, we have interpretations of nautical and weaving significance. We owe these interpretations to the ingenious arguments presented by McEwen. They are connected by the central theme she traces, that craft is fundamental to the meaning of the ancient Greek community. In the very image of the newly emerging polis in Samos and Ionia, "the shrine *(naos)* of the goddess became a ship (*naus*)," and the columns symbolically represented the oars.[148] Already in Homer, oars are connected with wings when the poet speaks of "well-fitted oars that are as wings unto ships."[149] Before the colonizers could begin to set up their polis, they first had to become sailors. One can only imagine the anxieties of the early settlers, and the fear and physical duress to which they would be subject, when they boarded their hollow boats and sailed for Ionia.[150] On this view, the temple preserved that experience by creating a winged (*ptera*) structure in its peripteral colonnade. Pliny explained that "the Greek word for the surrounding colonnade is '*pteron*,' 'wing.'"[151] The dipteral colonnade, the invention of Theodorus, is thus taken, on this view, to reflect the new ships developed through the seventh century which had two banks of oars. For at the beginning of the seventh century when the island of Samos decided to build a navy, it sought the help of architects from Corinth who superintended the construction of four vessels and these latest designs have been supposed to be two-banked galleys.[152] The temple and its colonnade preserved the trauma that united the colonizers in their polis, and it at once underscored the importance of craft, of the well-made ship of state, for their very survival together.[153]

Fourth, the columns along with the architraves formed the trabeated architecture that allowed the temple to appear symbolically as a loom. McEwen's argument is that essential to every household (*oikos*) was both the hearth (*hestia)* and the loom (*histon*, the same word that is used for the mast of a ship).[154] She reminds us that Homer's story of Penelope makes the point that Odysseus still has an *oikos* to return to after twenty years in absence thanks to her loom. Indeed, the common experience to all Greek children was to be with mother as she worked her loom; as McEwen put it, the loom must have seemed to the children to be as big as houses. The loom, she suggests, became a symbol for the house, and the vertical warp-weighted loom is "the simplest example imaginable of post-and-beam or trabeated structure."[155] Consider the image of women weaving on an upright, warp-weighted loom preserved on a lekythos dating to the mid-sixth century, opposite.[156]

Although trabeated architecture is perhaps derived from Egypt,[157] McEwen denied Egypt the possible contributing role on this account. For she insisted that the Egyptian looms were horizontal not vertical,[158] and consequently, the Egyptian temples had no peristyles, had no wings, which is another way of emphasizing the original developments of Greek temple building no matter what imported techniques and examples filled their minds as they began projects uniquely their own. The Greek temples certainly developed in an indigenous way. The peristyles that became a defining characteristic of them were not in evidence as a central feature of Egyptian temple design, at least not *externally*.[159] However, McEwen was mistaken about the use of vertical looms in Egypt. We have evidence already in the New Kingdom, preceding the Greek temples by almost a


*Figure 2.8*

*Lykethos vase displaying vertical loom, c. 560* BCE

millennium, of vertical looms in Egypt. Consider the wall paintings dating to the New Kingdom, reconstructed on the following page, displaying vertical looms (figure 2.9).[160]

Thus, had the temple design echoed the design of the loom, consciously or unconsciously, the inspiration could indeed have come from Egypt. In any case, on McEwen's suggestion, the columns and architraves had been interpreted symbolically to represent the loom, central to every household; just

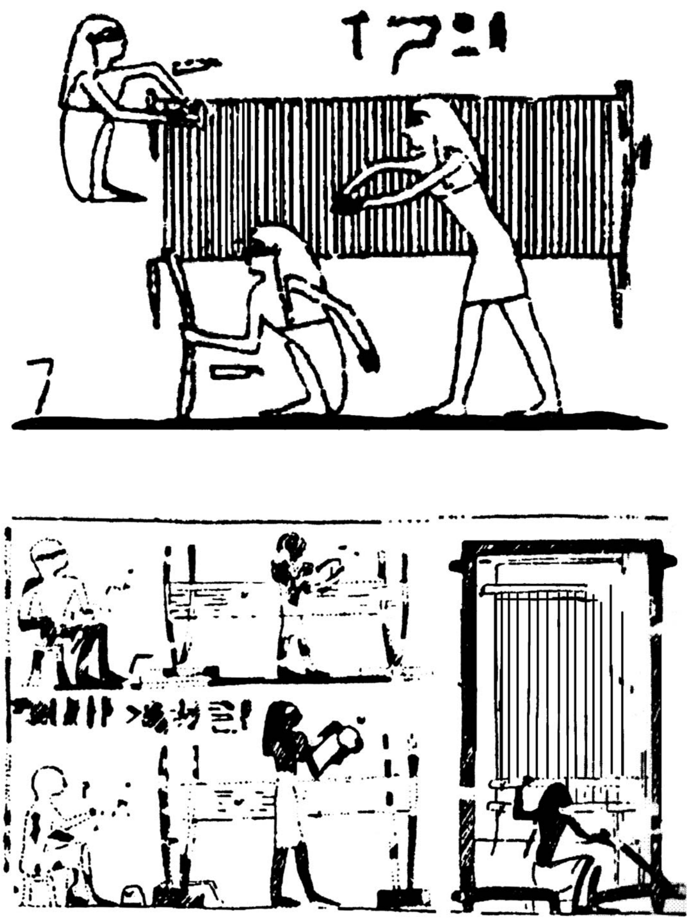


*Figure 2.9*

*Egyptian vertical looms from New Kingdom tomb of Nefer-hotep*

as the garment displays excellence because of the *harmonia* of the weaving, so also the excellent polis displays *harmonia* by weaving together the disparate strands in the community.[161]

Fifth, it has been hypothesized that the column has a peculiarly ritualistic meaning connected with the sacrifice. Greek religion is fundamentally constituted by two ingredients: sacrifice and prayer. Long before temples were built, the Greeks worshipped gods in sacred groves or fields. Pliny made the point long ago by suggesting that trees themselves were the earliest temples.[162] Sometime after, altars were set up nearby to make sacrifices to these divinities. When the temples were built much later, the altars, being older and thus more sacred, were almost never moved but rather the temple, the *naos*, that housed and protected the sacred idol, was oriented toward them. The temple was so positioned that when the great double doors were opened, the altar stood directly in front of the cult statue, presumably to view the ritual. We know that central to the ritual is animal sacrifice, and Burkert has outlined the details emphasizing the ritual in which the animal victim accompanies a procession to the sacred altar.[163] The animal's throat is cut, its blood is collected and splattered on the altar, its body ritually dismembered. Some parts are cooked and eaten, others are placed in the fire, wrapped in fat and from which smoke billows upward. The skull and bones are rearranged on the altar in the general outline of the beast and the animal's skin is draped over them, reconstructing or resurrecting the sacrificed victim. This much seems clear.

Hersey then argues that the temple construction consciously recreates the sacrifice, and the column symbolizes the sacrificial animal.[164] His argument appeals to technical architectural terms that he believes are drawn from the sacrifice. A column base, *basis*, is a foot; the *apophusis*, the hollow curve between a column's base and shaft is taken from the word for part of a bone or blood vessel; the trachelion and hypotrachelion come from *traxelos*, "throat"; and the capital of the column, the *kephalion* or *kephalis*, "head." The result of Hersey's analysis is that it allows him to reach the conclusion that the temple preserved the images of the sacrificial victim, the trophies of the sacrifice, and by so doing preserved the ideal of the ritual, namely, the "transformation of an animal into a god and then the further fusing of that animal-god with the worshippers."[165]

Given these five hypotheses for explaining the meaning of the design choices for the temple architecture, can we decide among them? For our purposes here, it is not crucial. Each hypothesis offers a plausible account inasmuch as each view can be accommodated by the temple appearance. Even if we dismiss as anachronistic Hersey's account that relies on an appeal to architectural terminology, the possibility that the design features gave imitative voice to the sacrifice that was so central to the sanctuary's ritual cannot be so easily dismissed. Perhaps the archaic architects did not consciously intend to give expression to the loom with their trabeated construction but that cannot be used to disprove the possibility that the image of the loom burgeoned in the minds of members of that Ionic community when they gazed upon the temple. Again, the architects might not have consciously selected the peristyle and then dipteral construction and so conspired to transform the *naos* into a *naus*, but the wings (*ptera*) of the dipteral construction might have rekindled the memory of the double-banked oars of the ships that conveyed them on the perilous voyage from the mainland. And, finally, since we have reason to suppose that the proportions of the columns might have been originally inspired by human form, although the argument that each column stands in *isonomia* from the center is patently false of a rectangular arrangement (unlike a circle), the uniform and measured distancing in the colonnade might well have suggested to this archaic audience the appropriate position of the citizen in the community even if it were not the conscious intention of the architect.

These hypotheses are not mutually incompatible even if we regard one or another as less compelling. What we are entitled to conclude without equivocation, however, is that the column, and the temple, had symbolic and cosmic significance. As the central ritual reveals, detailed by Burkert, the sacrifice was an extraordinarily symbolic process. Given their penchant for symbolism, the ancient Greek community could certainly have seen in their *thauma,* a political message, a craft analogy with the ship or loom, or even the sacrificial trophies. From this discussion we can see more clearly that when Anaximander called upon the image of the column-drum it was no throwaway, for the column already had symbolic and cosmic meaning to the archaic Greeks. Thus, regardless of which particular hypothesis we embrace most closely about the specific design choices of the temple in general and the column in particular, it seems clear that the purpose of the religious monument was to foster the consolidation of the divergent elements that comprised the polis through uniformity or regularity of worship. The symbolic unity it sought was fostered also *architecturally* by means of its symbolic meanings.

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3

# *The Techniques of the Ancient Architects*

## The Evidence for Imagining in Plan or Aerial View

The role that plan drawings played in architectural construction in both ancient Egypt and Greece has been a subject of debate. Since no architectural *scale* drawings survive from either place, no definitive case can be made on their behalf. Moreover, there are reasons to suppose that the archaic Greeks did not rely on them—these reasons will be taken up when the theory of proportions is explored—and reasons to leave the Egyptian case open to doubt. Fortunately, the case to be made for Anaximander's importation of architectural techniques does not require that the architects relied on scale drawings. While the successful execution of their projects required many techniques, in this section we focus solely upon the ability to think through, or imagine, their constructions from the plan view. The plan view, or aerial perspective,[1] is most certainly not our common perception of buildings, or most anything else for that matter. Indeed, monumental architecture overwhelms by virtue of its elevated presence. However, to control the construction process of large temples with colonnades, the architect must develop proficiency in an unusual technique, first to lay out the ground plan that identifies where each part of the building is to be erected, and then to imagine from the vantage point of aerial view directly overhead each course of the building as it goes up. This imaginative technique will ensure that the columns will effectively carry the architraves, entablature, and the roof (except, of course, when the temple is hypaethral), without collapsing under the enormous weight. The case to be made is that Anaximander imagined the cosmos from a plan view (or, literally, a horizontal cross-section), and the architects could have supplied this unusual technique. When the Greeks in Ionia started their monumental building projects in the late seventh or early sixth centuries BCE, the technique of imagining in plan view had been commonplace for the tradition of Egyptian architects for more than two millennia. The archaic Greek architects certainly could have learned this technique from them, in the absence of any ongoing monumental construction in Greece since the fall of Mycenae. What, then, is the evidence for the architectural technique of imagining in plan view?

The case for the Egyptian architects is abundantly clear. The accurate and detailed drawings of pylons, chapels, palaces, private houses, and other buildings on the rock tombs and temples of the New Kingdom prove, according to Arnold, that these artists "were certainly capable of drawing architectural plans and elevations for building purposes . . . [although] . . . no true building plan as executed by an architect for construction purposes has been preserved."[2] While we now tend to regard the undertaking of such large-scale projects as unthinkable without elaborate plans, the absence of them suggests that perhaps they were unnecessary for the building team. However, as Arnold put it, "Perhaps a rough sketch and some drawings of architectural details were sufficient," because a variety of plan drawings do in fact survive.[3] Thus, in outline, the case for the Egyptian architects is quite clear: they routinely imagined their building projects from the plan view perspective, and probably worked from sketches and informal drawings as the surviving examples prove, whether or not they ever worked from scale drawings.

The detailed case is multifold and makes appeal to evidence from all periods of dynastic history. Clarke and Engelbach argued the broad case that:[4]

(1) "Plans—and perhaps models—of the proposed building had to be submitted to the King";

(2) "Actual plans and models have been preserved";

(3) "There were palace archives where plans of temples were preserved, since in one of the crypts at Dendera an inscription states that the plan of the temple was found, written in ancient characters, in the palace of King Pepi" [i.e., sixth dynasty, Old Kingdom];

(4) "Another passage relates that a restoration had been made by King Thutmosis III [i.e., eighteenth dynasty, New Kingdom] after a plan had been found dating to the time of King Khufu" [i.e., fourth dynasty, Old Kingdom].

There are drawings, textual accounts, and inscriptions that all demonstrate that the Egyptian architects had mastered the plan view technique. We have informal drawings to instruct the builders, for example, on how to make a curve[5] dating to the Old Kingdom. There are informal layouts of a ground plan for a temple on limestone chips found in one of the quarries, and a ground-plan for an estate dating to the New Kingdom. There are plan drawings of tombs for Pharaonic burials that also survive from the New Kingdom, one a highly detailed example that offers exacting dimensions, and another that simply conveys the overall design. Besides the evidence for building plans stored in temple archives apparently dating back to the Old Kingdom, there are references to building plans ranging from the time of Queen Hatshepsut through the twenty-first dynasty of King Herihor.[6] Evidence for plan view techniques is also found both in inscriptional and textual sources for foundation ceremonies[7] in which the Pharoah sets out the temple dimensions by extending the *cord* and spreading out the *plan-net*. The surveying technique, by means of unfurling or extending a cord or line, and thus laying out a ground plan, is captured in well-known images of Peniny, a surveyor of the eighteenth dynasty, and also of Senmut, the statue of whom which now stands in the Louvre, is pictured below.[8]


*Figure 3.1*

*Egyptian statues of surveyors, Sennehem and Senmut, with measured cord*

The foundation ceremony is known to have been performed already in the second dynasty.[9] The scenes routinely picture the Pharaoh facing either the goddess Seshat, Thoth, or even Ptah, or a priest wearing a mask of one these divinities, and participating in a staking episode. Seshat, goddess of architecture and reckoning, seems to be the female counterpart of Thoth, for she too is recognized as the inventor of writing and the Head of the House of Books.[10] The famous relief scene of eighteenth dynasty King Thutmosis III facing Seshat, goddess of architecture and reckoning, both driving a tall stake into the ground, offers pictorial evidence—a cord is wound about both stakes as a symbol of the plan net—the accompanying inscription reads "The King [Thutmosis III] himself who performed with his two hands the stretching of the cord and spreading out the plan net, putting upon the ground."[11] And there are many other similar scenes depicting foundation ceremonies including one of Ramesses II at Karnak,[12] and another from Queen Hatshepsut's Red Chapel,[13] presented below.


*Figure 3.2*

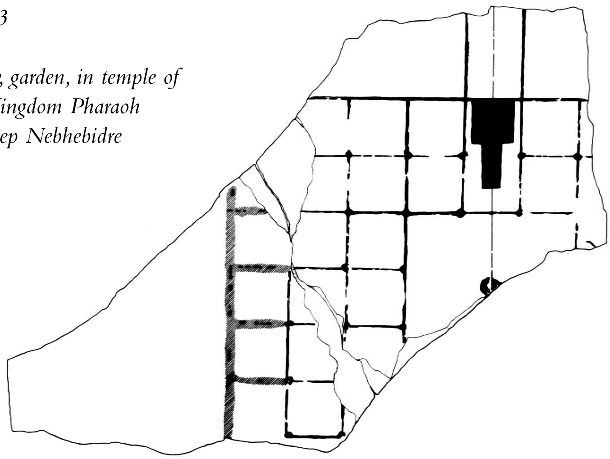
*Goddess of Architecture, Seshat, facing Queen. They hammer in the stakes, the cord is wrapped around the center. Hatshepsut, Red Chapel, Karnak.*

The drawings, the scenes, the textual evidence, and the inscriptions that describe these ceremonies offer evidence for ground plans, that is, an application of the technique of plan viewing. Let us examine further the specific evidence.

In the Middle Kingdom, in the eleventh or twelfth dynasty, evidence confirms the regular use of plan or aerial view. In this case, at the temple of Mentuhotep Nebhebidre at Deir el-Bahari, the plan for a garden or temple was found on a paving slab. The grid plan offers the technique for expressing scale. This is one of sixteeen plans and drawings Arnold identifies.[14]

*Figure 3.3*

*Plan view, garden, in temple of Middle Kingdom Pharaoh Mentuhotep Nebhebidre*



In the eighteenth dynasty, at the start of the New Kingdom, a wooden panel offers a plan view of an estate. The broad expanse of water at the bottom of the picture has been supposed to indicate either a canal or the Nile. There are measurements in cubits that enable us to determine, roughly to scale, the various regions that comprise the estate—the trees, the enclosure wall, the tank, forecourt, and perhaps even stonework are indicated by the open lines (figure 3.4).[15]

A very interesting dimensioned plan survives that incorporates both the aerial perspective and elevation, that of the tomb of Ramesses IV from the Valley of the Kings in Thebes. Gar-

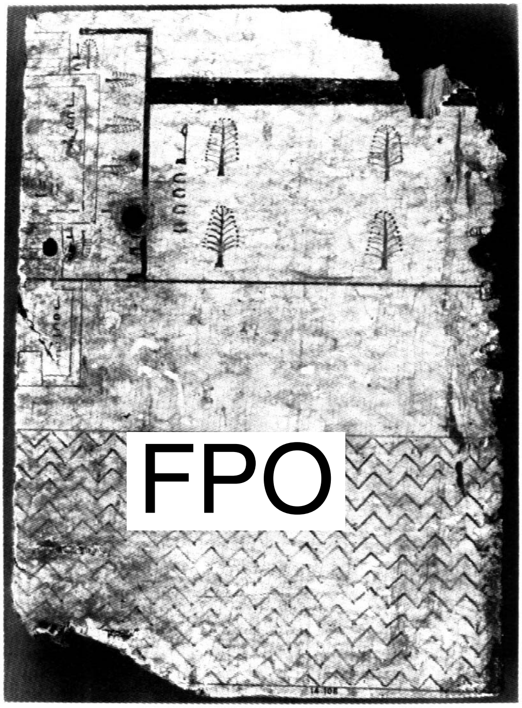
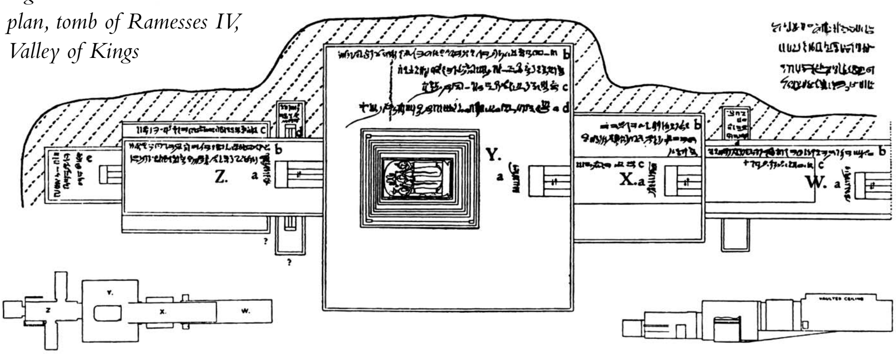



*Figure 3.4*

*Plan view of New Kingdom estate, on a wooden panel*

diner's translation of the hieratic inscriptions, presented by Clarke and Engelbach,[16] shows that while extensive details were provided that could have been used by the builders, the actual tomb measurements do not correspond.

*Figure 3.5 Dimensioned plan, tomb of Ramesses IV, Valley of Kings*

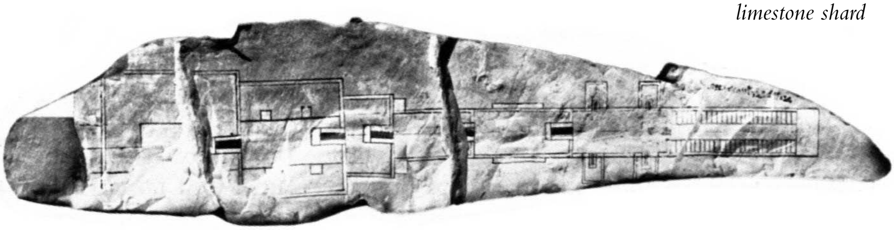


In chamber W, instructions are given, the doorways fastened (i.e., fitted with door and bolts);[17] the corridor dimensions are given as 25 cubits in length by 6 cubits in width by 9 cubits 4 palms in height; the side and chamber measurements are also provided. For chamber X, instructions for the door are repeated, the chamber is identified as the Hall of Waiting, and its dimensions are given in cubits, 9 × 8 × 8. Finishing instructions are also called out in a general fashion: "being drawn in outlines, graven with a chisel, filled with colors and completed." In chamber Y, again the door instructions are repeated, the dimensions of the House of Gold wherein the Pharaoh rests are given in cubits as 16 × 16 × 10, "being drawn in outline, graven with the chisel, filled with colors and completed, being provided with the equipment of His Majesty on every side of it . . ." and the measurements of the connecting corridors are also given. Finally, in chamber Z, after the door instructions are yet again presented, the dimensions of the Corridor of Shabti-place and the Resting Place of the Gods are given.

More informal sketches of tombs are also known, for example, the plan on limestone of Ramesses IX, also from the Valley of the Kings.[18] Unlike the extraordinary plan of Ramesses IV that contains details that could be useful both to the pharaoh and his architects in reaching agreement on the specifications, or the builders who would affect the plan, the sketch on limestone, pictured below, conveys the overall project in a kind of rough scale and perhaps served some informal purpose.

*Figure 3.6*

*Plan sketch, tomb of Ramesses IX, limestone shard*



We also have a comparably informal but full plan view of a large temple. The dating is in question but is conjectured to belong to the Amarna period, and hence New Kingdom. Arnold identifies the plan as a "grafitto." It was found in the quarries of Sheikh Said, and discussed by Davies in 1917.[19]

**Grafitto from the Quarries of Sheikh Said**

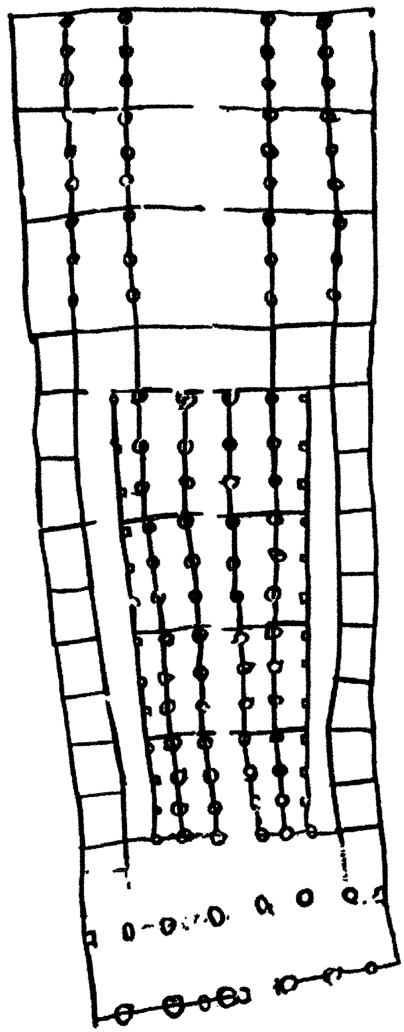


*Figure 3.7*

*Plan sketch of multicolumned temple, from the quarries of Sheikh Said*

What are we able to conclude about the ancient Egyptian technique of imagining in plan or aerial view? We can conclude that architectural technologies routinely relied upon imagining their constructions in plan view, a modest claim that would seem to require no laborious effort to make the obvious point. The more complex and difficult claim, that the ancient architects constructed their monumental buildings by appeal to *scale* drawings must remain in doubt, but the fact that they made architectural uses of drawings is certain. The evidence, covering an extraordinary span of time, testifies to the routine and importance of plan viewing as part of the technique by which the Egyptian architects succeeded in their megalithic masonry. The aerial view drawings on stone that survive are not to scale, and there is a growing consensus that the Egyptian architects did not rely on scale drawings for their buildings.[20] They may have been used to show Pharaoh or his appointed supervisors the details proposed, and more likely still, they may have been used by the architects to discuss the overall project with the builders; they do not seem likely to have been used as a votives or dedications, nor do they seem to have served as funerary gifts. Almost none of the surviving examples, as Arnold suggested, seem to have been intended as permanent records but were to be thrown away after completion of the task.[21] For this reason, most of these items were found among the debris in the process of various excavations. Can we reach such conclusions for the archaic Greek architects? Can we at least establish the routine and importance of plan view imagining?

The effort to document the techniques of the archaic Greek architects poses more formidable problems than the case for the Egyptians. This is in large measure due to the paucity of surviving evidence. Whereas the extremely arid conditions and the encroaching sands in Egypt often made possible the preservation of architectural evidence, the very different conditions in Greece have left us rather miserably informed of techniques in the archaic period. Nevertheless, since we have good evidence of routine procedures employed by the Egyptians from whom the Greek architects were likely inspired and tutored, and the very modest case to be made here is that the monumental buildings required at least the imagination in plan view, the case can be convincingly made.

Unlike the Egyptian evidence, we have no architectural drawings that survive from the archaic period. While scholar Coulton has emphasized the importance of a technique of design for monumental building he also argued that scale drawings did not play a significant role in archaic Greece, and since his writing a consensus has developed supporting his view.[22]

The case for such architectural drawings, however, was advanced earlier by Petronotis.[23] He argued that it made sense to assume that plan drawings were used once stone buildings developed because more complicated buildings required something more than memories for proper construction. He acknowledged, along with the rest of the chorus of architectural and art historians, that the multicolumned temples were inspired by the Egyptians, but he asked us to wonder how the "inspirations" were brought to Greece? The answer he proposed is by use of architectural drawings. The case he made calls us to imagine some aspiring Greek architects/craftsmen—house builders—who made careful drawings, at least roughly to scale, representing the Egyptian canons of proportions, so that when they returned to Miletus, Ephesus, and Samos they had before them clear illustrations of successful Egyptian architectural designs. Now, we do have extraordinary evidence for the Egyptian techniques of carving and painting wall decorations, making use of a grid, marked out by red chalk lines, some of which are still visible in unfinished tombs.[24] The craftsmen would have been working from drawings on a grid-lined papyrus, transferring the intended images to the walls, grid-by-grid, by differing scales established at different historical times on the papyrus.[25] This Egyptian technique of appealing to some reigning canon of proportions had been standard for some two thousand years when the Greek craftsmen came to learn Egyptian techniques in the seventh and sixth centuries BCE. Petronotis wondered if we should suppose that the Egyptians neglected to show them their tried and tested. To think that the Greeks were *inspired* by the Egyptians but left without making detailed drawings Petronotis regarded with ridicule. As Wesenberg put it in his review of Petronotis, of course the Greek architects made drawings.[26] The question for the architectural and art historians, however, was the far more difficult and technical one, namely, did the archaic Greek architects make scale drawings? And did they rely upon scale drawings for their successful monumental temples?

In order to meet this challenge, Petronotis also advanced other arguments. He noted, following Clarke and Engelbach, that the Egyptians had a royal ceremony of laying out plans; then, the architect laid out full-size plans, that is 1:1, on the site which even today prove to be exact indicators of ground plans. The Egyptians showed interest in the use of red-colored chalk lines, and then developed another technique of scratch lines; in Greece, Petronotis argued, *mutatis mutandis*, that the remnants of red chalk lines and scratch lines prove the existence of plan drawings. Conscious that he could only make a circumstantial case for the Greek architects, Petronotis decided on the strategy of focusing upon drawing materials, scratching tools and standards, to persuade his readers of his claim for architectural drawings: the chalk lines and scratchings reflected architectural plans from which the architects worked in just the way that the Egyptian tomb paintings reflected the grid plan drawings on papyrus from which those craftsmen worked. Again, the view that the Greek architects may have relied on rough sketches and informal drawings has not been the point of contention; the issue is whether they made precise scale drawings and required them to effect their edifices.

Where, then was the evidence for these scale drawings? In the absence of surviving examples, Petronotis considered several possibilities. He noted that, in Greece, writing and painting are evidenced on all different kinds of materials: wood and wax tablets, pieces of stone, metal foil, clay bricks, leather, papyrus, and especially in Ionia, animal skins. He even considered, and then dismissed, the use of papyrus in Greece. While papyrus, like writing, may have originally come into Greece through Phoenicia, the majority came from the Egyptian trade; however it was not only expensive but was limited in height, no example coming from the Middle or New Kingdoms being larger than 47cm. Of course, these pieces could have been glued together vertically, as they sometimes were horizontally (that is, making the roll longer), but we have no such examples. The more compelling material, according to Petronotis, was animal skin, which he suspects was the chosen medium, but the earliest surviving example exhibiting architectural use belongs to the late Roman period.[27] Of course, were he right, the animal skins from this early date would almost certainly have perished. And concerning the tools by which the architects could have made such intricately detailed plans, Petronotis suggested that the development of special tools in the early fifth century by mathematicians for measuring and drawing curves, for which we do have evidence, were perhaps provided by the architects; that is, the mathematicians were supplied techniques and instruments by the architects.

The case against scale drawings, however, is multifold, and so far these objections have carried the weight of current scholarly consensus. But this is not the case against the use of rough sketches and informal drawings which, by and large, has found a steady following in the community of excavators and architectural historians. First of all, if there were scale drawings they would have needed to be drawn on some suitable material. The great expense of papyrus, together with the fact that none sufficiently wide for so large a project survives, contributes to undermining the case. The possibility existed, of course, for a plan to be drawn upon a large clay tablet, as surviving examples from the Near East prove. However, the largest surviving clay tablet is roughly .35m by .50 meters,[28] that is, no significant improvement in size over the largest examples made of papyrus. So, on the one hand, the size of the clay tablets that do survive could not have accommodated a useful scale drawing of the monumental temples in Ionia, and on the other, we have no surviving examples from archaic Greece.

Second, and most significantly, the evidence suggests that a Greek temple could be described in complete detail using just words and numbers.[29] Coulton identified the use and importance of the *syngraphē*, in the absence of scale drawings, by which the Greek architects planned their buildings. The *syngraphē* was a technical specification in words and numbers that contained a general and clear explanation of the architect's design. Coulton relied upon two surviving examples, the inscription on a large marble stele dating to 340 BCE by the architect Philon of Eleusis for the construction of the naval arsenal at Peireus, and for which he offered a restoration plan, showing that it could be made from the description.[30] He also emphasized the Prostoon Inscription from Eleusis, slightly earlier but also less well preserved, that offers a good idea of the individual contracts into which the general specifications would be broken down. A sample clause is given below:[31]

> Stones to be quarried of Pentelic marble, length 17 feet, width 2 feet, thickness 1 1/2 feet, to be trimmed straight and square on all sides and handed over for loading sound, white, and unstained, and with appropriate surplus: in number 8. Stones to be transported from Pentelikon to Eleusis, length 17 feet, width 2 feet, thickness 1 1/2 feet, and to be unloaded in the sanctuary sound and unbroken; in number 8. Eight Pentelic stones to be dressed, length 17 feet, width 2 feet, thickness 1 1/2 feet, straight and square on all sides, and to be rubbed smooth, and to be hoisted and set on both of the thresholds, the joints being made tight and unbroken, and to be clamped and leaded, and to be dressed true on top.

The *syngraphē,* then, is part of the argument of how the Greek architects could have designed their monumental temples in the absence of scale drawings. It is not the whole argument since for this fuller view an investigation of the issues of both models and the theory of proportions must yet be taken up, but the appeal to the *syngraphē* is a significant part of it.

This evidence to which Coulton appeals to argue the case that the Greek architects did not rely on drawings to effect their constructions is very late for the case to be made about how the archaic Greek architects worked. While it certainly seems true that the design for the Greek temple had become conventional by the fifth and fourth centuries, it would be an overstatement of great magnitude to assert that claim for the late seventh or early sixth century, especially in Ionia where not a single Greek stone temple of monumental size was in existence prior to that time. Surely, more planning of every sort would have been necessary at this early date in Ionia. And it is hard to believe that rough sketches, especially in terra-cotta, for which we have so much evidence for techniques of drawing in the plethora of surviving pottery, did not play some significant, if informal, part of the planning prior to the advent of construction.

The modest argument for imagining in plan or aerial view, however, does not require an appeal to architectural drawings in the absence of surviving examples perhaps made on impermanent materials, though it is strengthened further by their likelihood. The case to be made rests on establishing that the architects routinely made ground plans before erecting their colonnades and the *naos* and *adyton*. They did so by means of various techniques involving both stakes and measured cords; and this technique of making a ground plan was most likely aided by rough sketches accompanied by exact measures affixed to them. Anyone with even the slightest knowledge of architecture will understand immediately that successfully measuring out the stylobate and marking out the dimensions of the column bases and their interspacings requires an aerial view. And proof of the use of this technique is all that is needed to supply a ready source in Anaximander's backyard for prompting him to imagine cosmic architecture in plan view. Nevertheless, the further case for the use of informal drawings by the archaic Greek architects in Ionia can be constructed by argument and not mere assertion.

One crucial piece of evidence for ground plans is produced by an argument that requires us to suppose that some sort of drawings with measurements, at least some rough sketches, were made prior to building. In the absence of surviving sketches, the argument goes something like this. The excavator uncovers the foundation of a building, for example, and establishes exactly the details of the foundation. Then, the excavator discovers that the complex details are in precise units of ancient measures—Ionic ells, feet, and dactyls. These results lead the excavators to assume the existence of some informal drawings that delineated a grid plan in unit measures, and then at the building site the ground plan would have been marked off and the actual construction would follow exactly these lines.

One material confirmation of such ground plans, and hence the technique of plan view, is the presence of guide lines in red chalk or paint on the foundation. Of course, various factors including climate, exposure, pollution, and tourism have all conspired to destroy such impermanent pieces of evidence,[32] and so

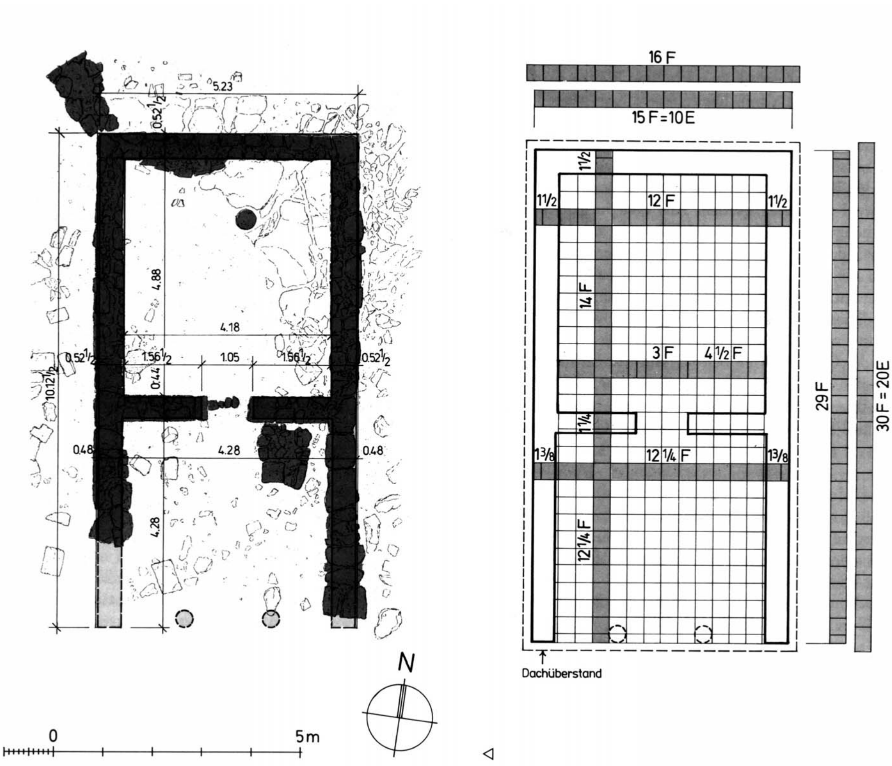



*Figure 3.8*

*Plan reconstructions of Anta Building, excavation and metrology, Miletus/Didyma* the existence of even a few examples testifies to their regular use. These lines confirm the theory that from informal sketches, and hence plan or aerial view drawings, the ground plan was set out that could not have been the mere result of stretching a measured cord and posting stakes in the ground or chiselling measure marks on the layers of stone. Some plan view techniques must have been employed prior to the making of the ground plan itself to coordinate all the specific details that the successful construction would require. Schneider's work in Didyma on both the so-called "Anta Building" and the "East Building" provides evidence for internally coherent metrological ground plans dating to the sixth century, and perhaps earlier.[33] Schneider reasoned in just this manner, that the exact measurements that the building foundation displayed presupposed some sort of a grid plan—a diagram or drawing—whose guide lines were set out and built over. The actual results confirm some sort of plan view preparations. The reconstruction of the ground plan of the so-called "Anta Building" (left) is presented next to the grid plan (right) that Schneider conjectures must have preceded the making of the ground plan itself (figure 3.8).[34]

Kienast's work on the so-called Temple D at the Samian Heraion, dating to the late sixth century BCE, has revealed just this technique.[35] He knew that the buildings indicated, by scratchings and other markings especially at the corners and shafts, that planning had been undertaken at the site prior to the construction. Reuther had made just these same kinds of observations long before when he described the excavation of the Dipteros I, and so we know that these same techniques of planning had been in use for the earliest monumental stone building at the Heraion.[36] But, at the so-called Temple D, Kienast discovered evidence of a complete ground plan (*eine vollständige Grundrißzeichnung*) marked out in red and transcribed to the foundation 1:1. This proves that the archaic Greek architects imagined their constructions in plan view, transcribed the plan to the construction site itself, and erected the building on the layout of those plans. And Kienast regarded that these scratch marks would not only enable an exact reconstruction of the ground plan but, moreover, would "show a revealing look into the sketching and planning of an archaic architect. . . ."[37] In the diagram below, after Kienast, the heavy black lines indicate the red lines found in the sixth century construction. As Kienast detailed it, "The opening of each distinct entrance by which the architect carried over his construction sketches of the building site into reality corresponds to almost all Greek buildings. The visible evidence of these sketches is, in general, short scratches of specific axis and corners that show the figure of the building. In contrast to this, the Treasure House D shows a complete ground plan. The lines have gaps in them, and so far as can be traced, are only occasionally carried fully through. However, they are much longer than usual scratches, sometimes even reaching 170cm, and are understandable only as part of a complete ground plan."[38]

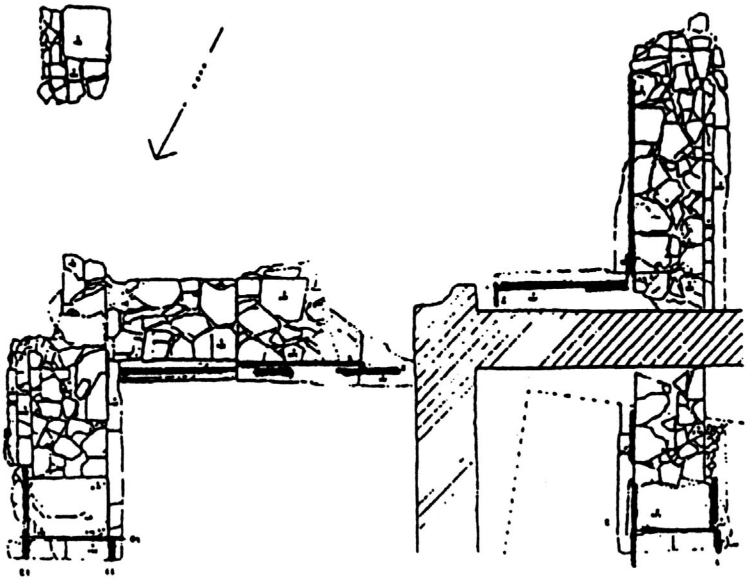


*Figure 3.9*

*Red chalk lines (heavy black lines) outlining plan, so-called Temple D, Samian Heraion*

In another project, Kienast published the definitive work on the planning and execution of the Samian tunnel of Eupalinos, an architect originally from mainland Megara.[39] Although the construction of this tunnel belongs to the second half of the sixth century, and is a feat of engineering that has no parallel within or without the Greek world at the time, Kienast's case is that it displays just the kinds of techniques and planning that were available throughout the earlier part of the sixth century. To put the matter succinctly, the tunnel, just like the tombs of the New Kingdom, could not have been constructed without a technique for imagining in plan view. The tunnel is more than a thousand meters long, and unlike the tombs of the New Kingdom, this extraordinary construction was driven separately from two sides; it runs some four hundred meters in the south end and just over six hundred meters in the north end. Kienast contends that the hill was staked out in order to determine the length of, and straight line for, the proposed tunnel. And he discovered at least five different marking systems in the tunnel—ancient survey markings—painted in red, one of which led him to speculate that Eupalinos invented his own tunnel measure.[40] But the great and unexpected difficulties for the architect, he concluded, arose in the north end when Eupalinos discovered softer stone and the occurrence of a great amount of natural ground water. Eupalinos decided to leave the straight line rather early on into the construction at the north end, as the excavation proved, in the attempt to avoid formidable difficulties. When he abandoned the proposed straight line, the technique of staking out the hill lost its effectiveness; then Eupalinos would have had to rely on a variety of plans to ensure that the tunnel halves would meet as initially intended. Kienast's reconstruction of the architect's techniques claims that while the survey of the original plan centered on the straight line that was staked out across the mountain crest and then, as it were, brought into the tunnel, a readjustment of this plan was necessary, more than once in the course of the digging, to handle unexpected deviations and yet still arrive at the anticipated meeting point. Without recourse to such plans, without having a technique that enabled the architect to imagine his project from the vantage point of aerial view, Eupalinos would not have been able to determine where exactly he was in the hill at any given time, and so be unable to control the project. Below is a sketch, after Kienast, of a layout of the plan. The two sides meet hundreds of meters into the hill with the level of the south end not more than a few feet below the level of the north tunnel.[41]

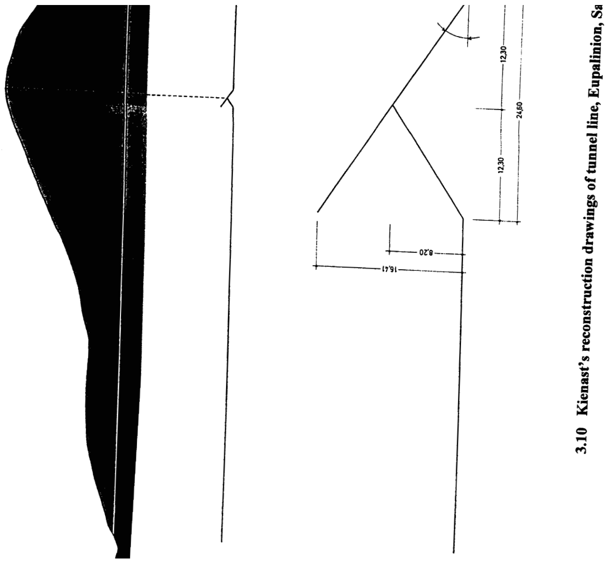



*Figure 3.10*

*Kienast's reconstruction drawings of tunnel line, Eupalinion, Samos*

Granting the paucity of evidence that survives from the archaic period, a wealth of new information on the temple of Apollo at Didyma was yielded by Haselberger's research[42] published several years after Coulton's excellent and important study, and although these new finds come from the younger Didymaion, from the fourth century BCE, we are entitled to plausibly confirm earlier practices. As Coulton put it in his discussion of the design of ancient buildings: "The building inscriptions of the fifth and fourth centuries tell us something about the methods of design then in use, and much of this must be applicable, if in a simpler form, to the sixth century."[43] Coulton's reasoning, fixing on the regularity of temple design for hundreds of years after its canonization in the sixth century, allows us to consider evidence that is both later and vastly more abundant than the meager archaic remains to cautiously but plausibly infer the earlier structures and techniques. Haselberger wondered about how the architects planned their buildings. As he put it, "In the absence of any descriptions of temple 'blueprints' scholars had no idea where to look for them."[44] But what he came to discover was that the blueprints were in front of the archaeologists' noses all along, for he "discovered an entire archive of construction plans still in place . . ." on the temple walls themselves.[45] "The drawings covered an area of approximately two hundred square meters in which they were finely etched into the walls."[46] Thus, Coulton's reasoning also works against some of his own particular pronouncements when Haselberger's new discoveries proved to conflict with his 1977 assessments. He dismisses the need for drawings, on several counts, but especially because by the fifth and fourth centuries the architectural productions would have become simply conventional; now the entire archives of drawings, as Haselberger put it, showed the real need for drawings—not scale drawings but rather full-size, 1:1—as late as the end of the fourth century BCE. Would not the drawings have been at least as important, indeed would not they have been much more important, in the absence of any standing monumental temples in Ionia in the early sixth century? And in any case, if we accept Coulton's reasonable assessment that methods of design from the fifth and fourth centuries must be applicable—even in a simpler form—to the sixth century, then all kinds of techniques for drawing, illustrations of precise curves, planning, and image making, would have been seen by Anaximander and his Milesian community. And, by Coulton's own reasoning, *mutatis mutandis,* such techniques would also have been in practice in nearby Ephesus and Samos at the same time. Let us, then, consider more precisely what kinds of plans and drawings Haselberger discovered in the fourth-century temple of Apollo at Didyma.

Haselberger discovered that the plans were drawn full-size, 1:1, rather than to scale. Important examples included the drawings for the construction of columns. These details Haselberger attributed to the importance with which the Greeks held this particular architectural feature. "[T]he shafts of these columns, almost 18 meters long [sc. about 60 feet] were drawn full-scale on the podium walls of the adytum. Of course, because the walls were not 18 meters high, it was necessary to draw the column on its side."[47]

By reviewing many other drawings and comparing them with surviving artifacts Haselberger came to some startling conclusions about the process by which the architects made their detailed drawings and realized those plans in the construction itself. "Geometrically pure paradigms were drawn first but the architects did not hesitate to alter them to suit their refined sensibilities."[48] Thus, the geometrically perfect plans were first but not final; beginning with a paradigm in the form of a drawing the materials were worked and reworked to achieve a desired appearance. The torus profile of a column base provided evidence for the architectural plan (left) vs stone torus (right), after Haselberger.[49]

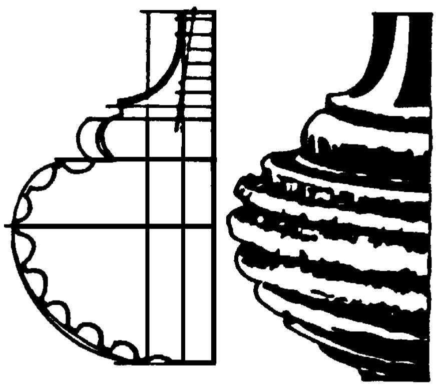


*Figure 3.11*

*Architectural sketch and stone torus, Temple of Apollo Didyma (Hellenistic), after Haselberger*

Haselberger knew very well that the construction of the columns and walls followed the construction of the platform and stylobate. And so he wondered if the architects had drawn floor plans on the floor as they had drawn columns on the walls. He discovered that they had. "The details of the floor plan had been drafted on the very layers composing the stepped platform. Each layer was laid in accordance with the full-size plans inscribed on the preceding one."[50] He detected other plans and came to the conclusion that tentative plans were traced out on a layer, and if they were accepted, they were copied from layer to layer until the platform and then the stylobate were fully realized.

At this point, Haselberger turned to look for the connection between the ground plan and the vertical structures drawn on the temple walls. If he could find them he would have an unbroken sequence of architectural plans. He discovered them too. The measuring guide lines for the placement of the walls and the columns were determined by a precise rectangular grid. "The grid markers are found in the only suitable place: along the base of the wall surrounding the nucleus of the temple. The markers consist of a series of short vertical lines that, although they are inconspicuous, have been incised with a precision accurate to one millimeter."[51] And having reviewed all these discoveries Haselberger concluded that if the tentative plans were accepted, they were copied in turn from layer to layer, while the earlier steps were erased—polished over—as they went. The only reason, he supposed, why plans remained at all was that the building never even neared completion.[52]

And not only in Didyma do we have such architectural evidence of drawings in plan and elevation. In the temple of Athena at Priene, Koenigs discovered a scaled-down sketch of its pediment, incised in a block that was later fitted into the building itself. And Hoepfner uncovered evidence of plans for a burial chamber that were drawn in red chalk on a segment of the temple of Artemis.[53] This technique of making guide lines for construction in red or ochre colored chalk is a familiar technique from Egypt, dating back to the Old Kingdom.[54] What, then, are we entitled to conclude?

We have evidence in several forms of the technique of plan view traceable to Egypt. Besides the plan drawings of temples and tombs on pieces of limestone, and reports of plans in temple and palace archives, we have reports and representations of foundation ceremonies that emphasize the use of stakes and cords to set out the ground plan, and the guide lines indicated in red chalk, likely corresponding to informal drawings. Additional scratch marks on the Egyptian platforms and stylobates show the builders where the columns and walls are to be set, and this procedure could only be organized by means of a plan view technique. In the monumental Greek temples, we also have evidence for foundation ceremonies, a significant indicator of which is the existence of pottery, dedicated to the god or goddess and buried directly under the foundation. It is often by means of this pottery that we are able to date the beginning stages of the construction. We have evidence for various plans, especially ground plans, in the archaic period in the sanctuary in Didyma, and at the Samian Heraion and the Eupalinion from Kienast; the presumed method consists in the use of stakes and cords to mark out the boundaries and other precise measurements within them. From Koenigs and Hoepfner, we have evidence through the fifth century of drawings that apparently had some architectural use, even if informal. And the extraordinary discovery by Haselberger provides a picture of a monumental project that relied in a significant manner on drawings in plan and elevation for architectural purposes, and shows that the architect had a real need to make use of precise drawings in the process of erecting his colossus made of stone. Although Haselberger's evidence belongs to the fourth century, it is difficult to believe that it does not reflect, even if in simpler form, techniques employed in the archaic period when Greek monumental projects were being resuscitated after lying dormant for about half a millennium. And this evidence, together with the earlier evidence that Kienast and Schneider present, suggests the likelihood that drawings and sketches of all kinds, and the instruments for making them, would likely have appeared in, at, or on the earlier temples, thus supplying Anaximander and his archaic community with the techniques of plan view, and the illustrations of technological productions.

## The Evidence for Models

The Egyptians were great model builders as the plethora of examples from all walks of life attest. These models, made from terracotta, wood, limestone, and other materials, were used to present scenes as divergent as masters and servants, offering bearers, kitchen work, bakeries, granaries, breweries, butchers' shops, storehouses, other industries such as spinning and weaving, laundering, brick making, shoemaking, all kinds of agricultural activities, and travel especially by ship.[55] Their existence can be documented from pre-dynastic times and extends throughout the course of Egyptian history. House models, made out of clay, are in evidence already in the pre-dynanstic period. One model, from Abu Zeidan of Naqada III date, consists of a terracotta bed surrounded by a rail; another is a model house from el-Amrah.[56] Two unique examples survive from the Middle Kingdom tomb of Meret-Re; the house models from the late eleventh or early twelfth dynasties are made of coniferous wood complete with a copper-lined pool and detailed trees.[57] The residences exhibit great detail, including carefully carved doors with bolts, windows with covering grills, and even copper spouts for drainage from the flat roof in the rare event of rainfall. So called Model A from the tomb of Meret-Re is shown below.

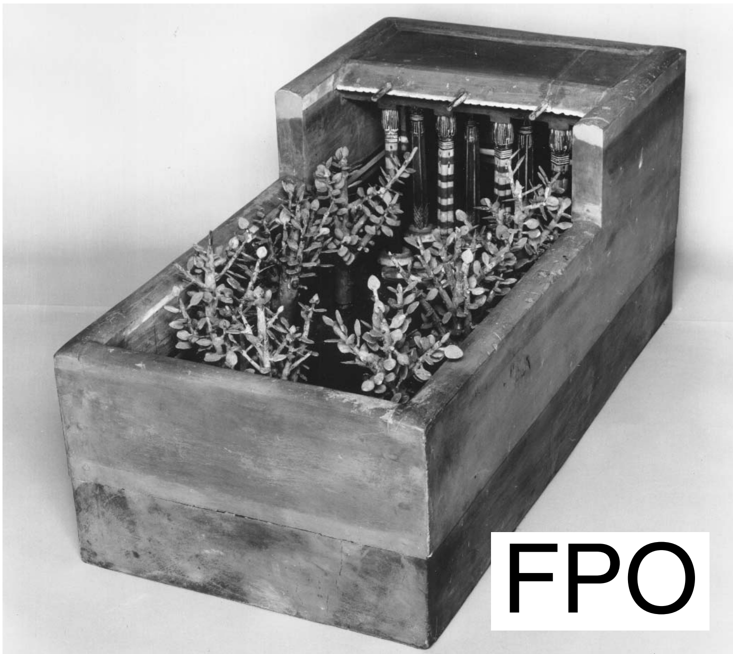



*Figure 3.12*

*Model A from the Middle Kingdom tomb of Meret-Re*

In addition to residences, there are other kinds of houses, commonly referred to as "soul houses," but we have found no example earlier than the Middle Kingdom. These models vary in size and complexity, ranging from simple huts to multistoried buildings with rooftop terraces, some even having domed silos and facades with colonnades.[58] In the soul houses dating to the Middle Kingdom, the courtyards commonly contain modelled food offerings of bread, vegetables, and meat; the New Kingdom examples, while preserving the same exterior house structure, lack the food offerings. Altogether, the residential models and the soul houses prove that such models were made for funerary use, and the famous granite base of a model of the entrance part of the temple of Heliopolis, from the time of Seti I, offers a clear demonstration that models also had a votive function.[59]

Furthermore, we know of at least one well-preserved model, roughly to scale, found in the valley temple of the pyramid of Amenemhat III at Dhashur.[60] It is made of limestone and illustrates in detail how a sliding block in front of the antechamber is to function, and the closing of the roofing block of the burial chamber, as found in the pyramid of Hawara. Since the model is neither inscribed nor painted in an attractive way, Arnold concluded, it was probably not a votive, although its actual purpose must remain unknown.[61] That model from the Middle Kingdom is presented on the opposite page (figure 3.13).

And yet another model of a New Kingdom temple in Heliopolis, dating to the nineteenth dynasty, has been preserved. Wildung described it this way: "Architectural projects were also presented in three-dimensional models. Here a quartzite block was used to mark out the locations of the pylon, obelisks, flagpoles, statues and sphinxes. . . . The various architectural elements have been reconstructed on the original base (figure 3.14)."[62]

Now, granting that we have technically detailed house and temple models over great spans of time from ancient Egyptian history, can we infer that architecturally useful scale models were employed in the technical process of building monumental architecture? Clarke and Engelbach in 1930 believed that we could. They declared that "[i]t can hardly be doubted that the

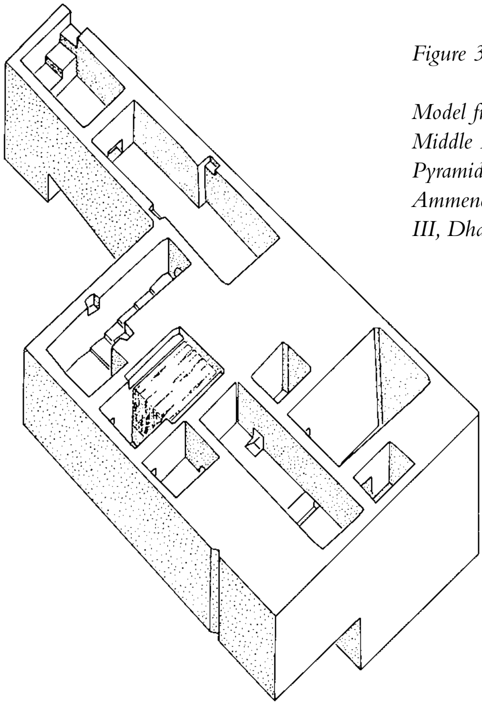


*Figure 3.13*

*Model from Middle Kingdom Pyramid of Ammenemhat III, Dhashur*


*Figure 3.14*

*Model of a New Kingdom temple in Heliopolis*

Egyptians, in addition to plans drawn on stone and on papyrus, made use of scale models."[63] Their argument turned on two issues: first, the solution to the problem of determining the point of balance of an obelisk, in light of the primitive state of their mathematics, would have been impossible without a scale model; and second, a granite model dating to the time of Seti I seemed to them to be such an example. The consensus half a century later seems more tentative. While we have evidence that it was customary to have a royal ceremony that preceded construction in which a model was presented to Pharaoh for his approval, such a model would not have had to be made to scale but only "roughly to scale," that is, merely close enough to convey the overall form of the project. Such a model, made for the purpose of persuading the patron, would need not contain the necessary details to be useful to the building team. And in the absence of a surviving model that is unambiguously made to scale, there has developed some consensus that, at least, the Egyptian architects probably did not make use of scale models in a manner comparable to that of modern architects. However, the most recent pronouncement on this matter by Arnold—"[W]e are not sure that the ancient architects made *as much* use of models as do architects today."—seems to concede some architecturally relevant purpose for them.[64] Thus, although the regular use of scale models for architectural construction must remain in doubt, we have abundant evidence connecting architectural technologies to model making for purposes as diverse as persuading the patron, votive and dedication, funerary, and perhaps even to convey a general idea of the intended project for the architect or building team. Can we reach such conclusions for archaic Greece?

The discussion of models in archaic Greece can be presented in two parts: the evidence for house/temple models, and the technique of modelling undertaken at archaeological sites and quarries. The first requires an inspection and reflection upon the surviving models, their locations, and their purposes; the second requires a consideration of two technical architectural practices known as the *paradeigma* and the *anagrapheus.*

The most complete study of models connected to architectural technologies in archaic Greece is the recent work of Thomas Schattner,[65] based upon an analysis of some fifty-two surviving house models. I include houses and temples, since the temple is the "house" of the god, and it is not possible to be certain which models are of houses and which of temples. Schattner is able to identify their purposes to be dedicatory, in some case funerary. Although he concludes that the surviving models could *not* have served as the scale model does for modern architects, he also shows that the models were reasonable likenesses of an actual building, close enough so that one can recognize the overall structure of the temple or house from them, and thus "roughly to scale." Let us consider the matter more closely.

The older theories about the house models rested on interpretations advanced in the late nineteenth century by Benndorf,[66] Pick,[67] and Blümner,[68] who followed the lead of Schlosser.[69] Their theories did not rest on interpretations of the fifty-two house models that Schattner identified, since their existence was unknown at the time. Rather, the older theories rested on appeals to two texts, one by Pausanias[70] and the other by Strabo,[71] and their argument was that these texts suggest that there were ancient house models and they served the purpose, akin to the one they now serve for the contemporary architect, of guiding construction. Schlosser, followed by Benndorf, pointed to the passage in Pausanias where Apollo is said to have sent the second Apollo temple, made of wax and feathers, to Hyperboreia, and that passage was interpreted to mean that there was a model and that it was transportable. If this interpretation is accepted, while it would point to the existence of models made of impermanent materials, Schattner points out that the fact that it is being carried by a god undermines the claim that the temple was of model size; there is no way to infer its diminutive size from the fact that a god (of indeterminate size) is carrying it. Blümner tries to make a comparable case by appeal to the passage in Strabo where he argued that the emigrants from Helikos demanded a model of the temple. However, as Schattner shows, this passage too will not provide the required proof because in the passage the focus is on the icon of the god that is desired, not the temple itself.[72] And so, the older theories, that models were made prior to construction and essential for architectural success, were undermined when the evidence to which they appealed was undermined. But, perhaps the new discoveries of all these house models, unknown a century ago when Schlosser, Benndorf, Pick, and Blümner wrote, could resuscitate these older interpretations? Schattner argues against such a view that the models could have been used as the contemporary architect employs a scale model, that is, as a significant indicator and guide to the construction itself. Schattner's main contention is that these models were not built to scale, but that would be essential for a planning model. They lack the precision to be useful as either an indicator or guide for a builder, and they lack the crucial details that would enable the building team to understand how to erect the proposed model.

If the models did not serve an essential purpose for the architectural construction itself, then what purpose(s) did the models serve? Schattner argues that the meaning of the models can be determined from the places where they were found. The vast majority of the models were found in sanctuaries and thus may be regarded as dedicatory offerings.[73] All the models that have been found thus far belong to the geometric and archaic periods, and indeed the tradition of dedicatory models comes to an end with the end of the archaic period.[74] Furthermore, while temple dedications suggest that the dedicator sought protection by a deity for a temple/house, interestingly enough, they always belong to the sanctuary of a goddess.[75] However, since there are also some models that were found in the graves of women, the classification of "dedicatory offerings" alone is insufficient to account for the purposes of these surviving examples. Schattner supposes that these models represent the house of the deceased, and in any case offer evidence for the use of models as funerary gifts.[76] Furthermore, the model from Archanes in Crete[77] assumes a special place among the Greek models because it most closely resembles Egyptian models; this should not come as a surprise since there is abundant evidence of a connection during the Bronze Age between Minoan Crete and New Kingdom Egypt, whose effects are evidenced through the geometric and archaic periods.

Schattner argues that from the surviving evidence we can conclude that the ancient models were not architectural fancies but rather represented actual buildings. In this he follows the lead of earlier research.[78] Although these models lacked the precision required for architecturally useful scale models, they offered a conscious selection of building elements that were seen as important for characterizing a building, and consequently provide significant information on early architectural design. While we are not able to reliably identify the specific large-scaled buildings after which all of these items were modelled, it is certain that there must have been an actual building corresponding, more rather than less, to those depicted by these models. Schattner defends this claim by pointing to what he calls the "groundplan typologies," that many surviving groundplans of "large" architecture, uncovered in excavations, exhibit plausible correspondence through exterior proportions. It must be kept in mind that the Greek models only display the exterior structure of the building; the internal structure, not supplied in the models, would have revealed the building function—house or temple? Thus, Schattner can conclude that most of the surviving models may be seen as examples of what he calls a "folkloric" form of dedicatory offering.[79] While not depicting the temple or house exactly, the model bore a close resemblance to an actual building and highlighted the characteristics that were deemed most significant to it. Let us examine a few models to make these points clearer.

Four models were found in Perachora dating to the ninth and eighth centuries BCE. The model, in its present state, and following reconstruction, after Coulton, is presented on the following page (figure 3.15). We should consider the architectural details that the model builder displayed.[80]

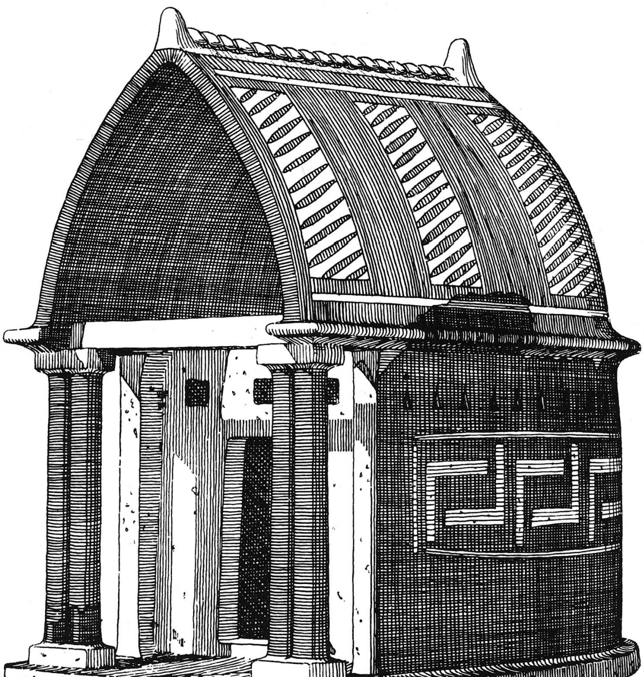


*Figure 3.15*

*Reconstructed model of early archaic temple in Perachora*

In Argos, so far only one model has been found. Like the one from Perachora, the Argos model is more or less rectangular; however, its roof is more sharply pitched, certainly at a greater angle than any pediment we know of from the classical period. While the Argive model is square-ended, its porch framed with square timbers and covered by what seems to be a separate roof on which (as a wall plate) the steep-angled roof rests, the Perachora model has a hairpin plan, an overhanging roof presumably of thatch, with walls of rendered mud brick, and a porch supported by twinned round posts. The Argive model may have had a clay roof set upon reeds and it was apparently painted like the walls. The ribbed walls indicate a half-timbered construction. Below is a reconstruction of the Argos model.[81]

From the excavation at the Heraion in Samos some thirty-five models were identified. While most of them date from the seventh and sixth centuries BCE, the earliest pieces date from the

*Figure 3.16*

*Model of early temple/house in Argos*

eighth century.[82] While we do have examples with flat roofs, the model reconstructed below is an oval-ended house with a thatched and pitched roof, and made out of limestone.[83]

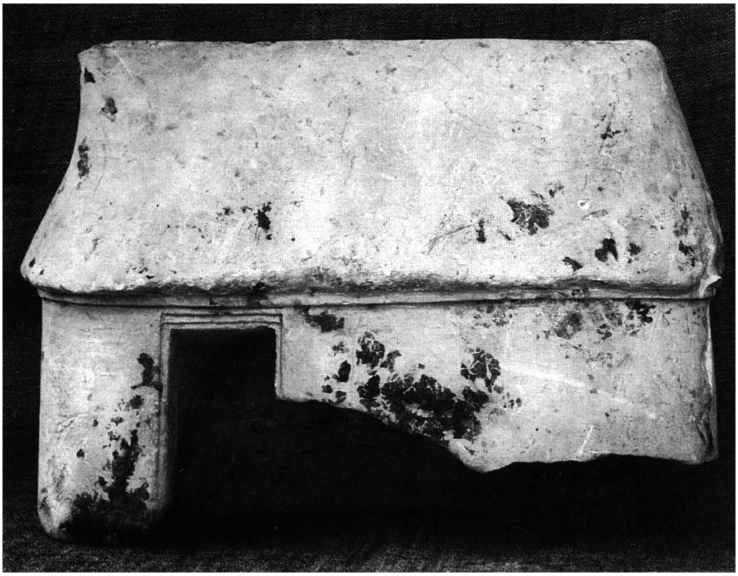


*Figure 3.17*

*Limestone model of oval-ended temple/house in Samos*

Finally, the unusual model, opposite, has a special place among Greek house models. It is from Archanes in Crete and seems to show parallels with Egyptian models, despite the obviously large chronological gap in this connection.[84]

Now we turn to the second part of our discussion of models and focus upon the architectural techniques known as the *paradeigma* and the *anagrapheus.* While our contemporary predilections tend to suggest that a model must be a small-size replica of a larger object, there is also another sense of model that we and the ancient Greeks share. In this second sense, a model is an exemplar, a perfect instantiation of some ideal. We understand immediately the idea of "the model citizen" who pays his taxes and obeys the laws, of a "model kitchen" at the hardware store that presents exactly the coordinated items that would produce an ideal place to cook and eat, and even our attempt to identify

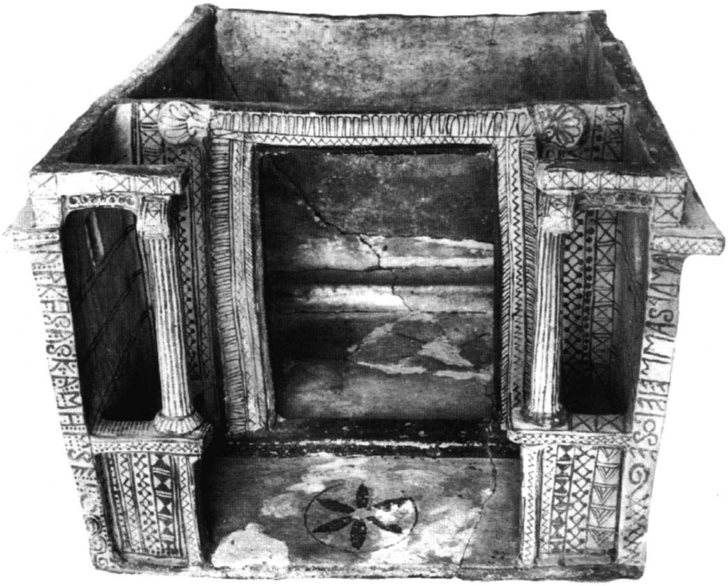


*Figure 3.18*

*Model of house from Archanes in Crete*

special people as "role models," those individuals who exhibit characteristics that we find laudable. We must come to see, in just this sense, that for the ancient Greeks a model could also be an exemplar; while not a smaller version of something else, a model could also be the ideal example in 1:1 proportion. For architecturally speaking, in addition to the surviving house/temple models, we also have evidence for these other kinds of modelling techniques undertaken at the building sites and quarries. We have already considered the primary role that the *syngraphē*, the detailed description of the proposed building in words and numbers, is thought to have played in architectural construction. The *syngraphē* offers a credible response to those who might have insisted earlier that the successful building of monumental temples required scale drawings. Analogously, the *paradeigma* and *anagrapheus* are part of the credible response to those who might have insisted that the architects also required scale models.

The *paradeigma*, which Coulton translates as "specimen" or "example," has a curious historical predicament that clouds our clarity in grasping its meaning.[85] Herodotus used the term *paradeigma* in an architectural reference to the project of rebuilding the temple of Apollo in Delphi in the second half of the sixth century, and it seems as if he must mean a small model of the entire temple.[86] This is the famous passage in which the aristocratic Alkmaionids, patrons and supervisors, wealthy and of great reputation, were said to have substituted the finer Parian marble for the originally proposed tufa stone, and so improved the *paradeigma*. Coulton understands that the term should mean "scale model,"[87] and indeed "model" is the conventional rendition among the translators,[88] but Coulton takes it to mean "specification" since the substitution was of material rather than structure and suggests this would be easier to call out from a description rather than from a model. Schattner also agreed, echoing Coulton's sentiment, and pointed out that there is no evidence in later occurrences for the use of the term *paradeigma* for entire buildings but only for building elements.[89] Although the position of Coulton and Schattner on this matter is open to a challenge, there might be room for a reasonable interpretation that there was a model made of the temple of Apollo. One might even speculate that there were routinely models of other archaic monumental temples. The purposes of such models might have included both showing the patrons who were financing this enormously costly operation the proposed product prior to the construction and subject to their approval, and for the architects themselves to display their aesthetic sensibilities as they made final decisions on their project. The model need not have been made to scale, only roughly to scale, to convey the overall design of the building, just as the house/temple models that Schattner details bore a sufficient resemblance to actually existing buildings that enabled him to conclude that the models were not mere fictions. The argument that we have no other evidence for the term applied to entire buildings cannot rule out the appropriate application of Herodotus's term to the whole building in these early stages of construction. Herodotus says *paradeigma*, not *syngraphē*, and no one has disputed the text as being corrupt. To side with Coulton and Schattner on this point requires that we conclude that Herodotus meant to say *syngraphe* but mistakenly said *paradeigma*. Now, however, if indeed there were a model, then the tufa stone (i.e., a kind of limestone) would have had to be carved; this would certainly have been possible as surviving models from the archaic Samian Heraion carved out of limestone prove. On this possible interpretation, the model of the proposed temple of tufa stone was carved out of tufa just as the model of the Samian building was carved out of limestone. There seems to be no good reason to deny the most obvious and compelling testimony of this very early evidence from Herodotus, especially given the numerous surviving examples of dedicatory models. And if the purpose of this small model was to display the proposed project to the archaic patrons for their approval,[90] analogous to the routine in Egypt, and thus was not an *anathēma*, it should come as no great surprise that the model fails to survive. For unlike the models dedicated in the sanctuary, such a model would have outlived its usefulness upon the completion of the temple and so could be discarded. In fairness to Coulton and Schattner who certainly might have it right, however, it should be duly noted that this would not be the first time that Herodotus simply got it wrong, and that perhaps he did mean *syngraphe* when he said instead *paradeigma*. But this is a curious way to undermine an argument that there were small models, roughly to scale, made prior to the construction to persuade the patrons or even to illustrate to the architects themselves the aesthetic sensibilities of their anticipated product in the planning stages, especially in light of the extraordinary and costly nature of such a project. The patron was, after all, committing to something that would require hundreds of men laboring possibly decades to complete.

The broadly accepted construal of *paradeigma*, however, is that it referred to a specimen or example, and this position was reached by an appeal to the building inscriptions. From them we learn that a *paradeigma* was used for architectural elements such as triglyphs or capitals, which required a design in three dimensions and also indicated carved or painted decoration.[91]

The works of Coulton and Haselberger[92] help us to reach the conclusion that the usual meaning of *paradeigma* is a model 1:1 of a substantial architectural element, such as the capital; it was present at the building site, usually made of some impermanent material such as wood, clay, or stucco, and to be copied exactly into the more permanent stone material. There is, however, at least one example of a *paradeigma* made of stone, but this one was to be fitted into the building itself.[93] The presence of such a model at the site, then, would have made it easier to accurately reproduce the element to be replicated, with calipers rather than by imperfectly divided rulers, which would always carry the greater risk of costly error. Coulton defends his case further by appeal to the specimens of tile standards in three Greek cities—one still on display in the Athenian agora—illustrating that if one had doubts about the measure of a tile, one would have brought the tile to the marble standard in order to have it checked directly rather than by appeal to a written specification setting out the required dimensions; this seems to be the *epharmozein* method that Thales adopted.[94] The usual meaning of *paradeigma*, then, is a 1:1 model of an architectural element.

Finally, there is the *anagrapheus*. Since *graphō* in Greek can mean either "draw" or "write," the little-used term might refer to either a delineation or a description. The case for delineation or drawing, on the one hand, is that it is the most suitable way to convey architectural details, while, on the other, the case for written description consists in an appeal to an inscription in which the term *anagrapheus* is applied to the quarrying of metopes, that is, plain rectangular slabs, for which measurements are really all that is required and a drawing would seem to be able to add nothing useful.[95] Coulton concluded that the evidence, based on appeal to a passage from Heron of Alexandria,[96] suggests that it means a "template, used particularly for blocks with complex mouldings that could be specified by a two-dimensional profile."[97] Thus, we have yet another kind of architectural model, also 1:1 and not to scale, that could be found at the building sites to ensure accurate replication of a specified two-dimensional design.

What conclusions, then, can be reasonably secured from our two-part discussion of models connected to architectural technologies? First, there are conclusions to be drawn from Schattner's study of the surviving house/temple models. There are, to begin with, negative conclusions. There is no compelling evidence from these small models to suggest that they had been used to guide the architects or the builders for construction purposes. This is because they were not precise enough to be of use as scale models, nor did they include the details that would have enabled the builders to effect the constructions for which we do, in fact, have evidence. That is, these models do not display the detailed techniques that the archaic buildings themselves exhibited. Furthermore, the ancient literature will also not provide compelling evidence that the architects employed scale models in their constructions, for neither does the passage in Pausanias nor the one in Strabo provide compelling testimony for them, as was once alleged.

But there are positive conclusions that can also be reached. First, beginning in the geometric period and continuing through, but ending in the archaic period, we have abundant evidence for a model-making tradition connected with architectural technologies. The weight of the scholarly literature has now reaffirmed that the small models are of existent buildings rather than fantasies, and hence we can learn some important things about early architecture and design from a close examination of them. This also means that although the dedicatory or funerary model was built neither to scale nor in sufficient detail to be essential for the building process, the model was close enough to scale to convey a reasonable idea about what the actual building looked like. This tradition of model making, then, connected to architectural technologies, was capable of communicating the products of building enterprises roughly to scale. Thus, the small model could express with sufficient clarity the overall dimensions of the building, that is, the external proportions without which the identification of them with actually existing buildings would have been impossible. The models also conveyed sufficient detail to reveal much information about actual temples or houses; in this sense, the model could communicate an idea with clarity, not only to other members of the community, and perhaps the patron, but most especially to the goddess whose protection was sought for this particular temple or house by means of this dedicatory gift. And therefore, as a votive or *anathema*, the archaic community came to recognize that the small model was an appropriate gift to dedicate in the sacred precinct.

Although we now tend to think of a "model" as being a small representation of a larger thing, standing in some scale proportion to it, we must come to see that the idea of modelling for the ancient Greeks extends to exemplars that illustrate an ideal in 1:1 proportions. The *paradeigma* and *anagrapheus* are just these sorts of models in 1:1 proportions, and they were clearly fundamental to the architectural construction itself. Moreover, perhaps Herodotus was not mistaken when he used the term *paradeigma*, and that *paradeigma* also had a range of meanings in the archaic period that extended to a small model of an entire temple; if so, there might well have been a small model made of the entire temple for the patrons' approval, roughly to scale and prior to the construction. Indeed, we cannot rule out the possibility, perhaps even the likelihood, that in the planning stages that preceded these enormous temples, especially in the early archaic stages, models out of clay, limestone, or other impermanent materials (such as wax and feathers?) were constructed and are now lost. And had this been routine in the sixth century when monumental temple building inspired and tutored by Egyptian sources was just beginning to flourish, we would then have evidence of yet another purpose for small models, roughly to scale like the house/temple models of which we know, whose purpose was a part of the planning process, even if the small models were not made exactly to scale. Like the matter of architectural drawings, however, suspicions that there were model-making exercises in the planning stages cannot be demonstrated unambigously by appeal to the present evidence, even if the supposition seems terribly attractive. Be that as it may, the *paradeigma* and *anagrapheus* of which we can speak confidently provided building exemplars and templates, 1:1 models at the building site, and offer further convincing proof of model-making activities connected to architectural technologies.

Our aim in exploring the house/temple models, and the *paradeigma* and *anagrapheus*, was to consider model making, contemporaneous with Anaximander, that might have contributed to or stimulated the model making with which he is credited. We can acknowledge that model making connected to architectural projects could have supplied such a source, and could have helped to ready his archaic community to be open to cosmic discussions, drawings and models, especially if they were illuminated by and illustrated with architectural analogies and exemplars.

## The Theory of Proportions

The archaic Greek architects apparently did not require scale drawings to build their monumental temples, but that does not mean that they did not make drawings; and they apparently did not require scale models, but that does not mean that models were not made for other purposes, architectural and dedicatory. Our discussions of plans and models have helped us to understand better the design techniques for monumental construction. It seems that, first of all, the archaic patrons and architect at some point early on in the process reached an agreement on the temple dimensions and central details. That agreement was likely written up in words and numbers producing a *syngraphē* that served as both a contract and a general description for the builders. With the *syngraphē* in hand, the architects likely made rough sketches of the proposed temple and assigned numbers and measures to the various elements in the drawing. Then, once the ground had been levelled, the architect would have laid out the ground plan, by means of cord and stakes, by reference to the informal drawings in plan view. The various measurements would have been marked off, and the platform would have been installed followed by the steps and the stylobate. Then, a new series of measurements indicated by scratch marks would have been made, likely also by reference to some drawings. At this point, with the coherent metrological ground plan established, the construction of the column bases, the *naos*, and any other architectural details that took place at ground level could begin. In the meantime, architectural elements such as capitals and drums would be made as models, 1:1, and placed at the building site to be copied; so also for the two-dimensional templates that would also be present for detailing blocks with complex mouldings. This is the picture of archaic temple building we have developed so far. But some important general strategy is missing. How are we to suppose that the architects decided on the size of the stylobate, or the diameter of the columns, or the intercolumn spacings? Even more challenging are the questions, how did they determine how high to make the columns, the architraves, or the entablature? The architectural historians' answer to these fascinating questions is commonly referred to as the "rules of proportion." Before we investigate the case for these Greek rules, however, can we discover any hints from their Egyptian contemporaries and predecessors?

In a recent major study on Egyptian building techniques, Arnold outlines and details an extraordinary assortment of relevant information.[98] He offers evidence for plans and models which we have already considered. He details techniques for measuring—distances, inclinations, levelling, and right angles—and marking indicators—setting, levelling, and inclination lines, for blocks as well as for columns and pillars. He describes techniques for quarrying and dressing both hard and soft stones, and for transporting them by carrying, lifting, or lowering, through roads and up ramps. Arnold provides the evidence for techniques by which the Egyptian architects made foundations, laid the blocks, secured the joints, used bosses, stone paving, and other masonry techniques for walls, casings, and roofing. He offers illuminating descriptions of how shafts and tunnels were dug out, tombs secured, techniques of scaffolding employed.

And he provides abundant evidence for tools used in the process of building—measuring tools, cutting tools, and moving implements. What is missing from his magisterial work is an account of the design techniques by which the Egyptian architects worked. This should not be interpreted to be a criticism of Arnold but rather testimony to two things: his careful approach not to venture off from what the evidence allows, and the fact that, despite some three millennia of ancient Egyptian architecture and centuries of research, there is still no consensus on their design techniques. This is not to say that others have not offered conjectures, nor that Arnold did not know of them.[99] By reference to the theory of proportions in Egyptian painting and sculpture, about which the evidence is clearer, there have been those such as Badawy who have argued for some sort of analogous theory of proportions in architectural design. The specific theory he advocated was one he termed "harmonic design,"[100] and the key to it was to be found in the 8:5 triangle, in very close approximation to the golden section. Badawy did not argue that the design technique was based on mathematical calculation or number mysticism but rather that it grew out of an aesthetic sense.

Badawy's thesis is built upon a series of fifty-five case studies of plans and elevations belonging to all periods of Egyptian history. He claims that the parts of the buildings are all related to each other based on a series of geometrical figures—namely, the square, and a number of triangles of set proportions, for example, the right-angled 3:4:5 triangle, and the 1:2, 1:4, 1:8, and most especially the 8:5 isosceles triangles. Thus, Badawy contended that the Egyptian architects made use of a formulated system of design principles, and that prior to the building itself, scaled drawings were made using triangles (often in 8:5 proportions) as drawing instruments, and then those designs were transferred to the actual building site. Despite the importance of his claims, as Kemp and Rose assessed, Badawy's work has had little impact on Egyptologists.[101] The problem has been that in the absence of surviving scale drawings, as we have already discussed, Badawy's theory is first of all too conjectural. While the data he has amassed are certainly impressive, the persistent problem is whether we can infer that the architect consciously intended to produce these designs or rather that when we impose our geometrical or aesthetic sensibilities upon them, it just so happens that they are amenable to these patterns. Kemp and Rose described this dilemma as whether Badawy's elaborate diagrams simply picked up aesthetic preferences long formed by tradition but still unconsciously articulated, or whether instead he had discovered the procedures used by the ancient architects.[102] The study by Kemp and Rose argues against Badawy's thesis. They reject the idea that the Egyptians made scale drawings, and with that Badawy's thesis fails; we then are left with the possibility that while we do discover an innate sense of balance and harmony by placing particular analytical diagrams or patterns over plans or elevations, we do not have sufficient grounds for claiming that this is how the ancient architects went about their work.[103] Instead, Kemp and Rose make a different recommendation about the outlines of Egyptian architectural design. They believe the fundamental design technique rested on basic units of construction—cubits—expressed in drawings or sketches with measures and numbers attached, which an imaginative architect would then fill out in the details by appeal to experience.

> One thing that does come across very clearly . . . is that Egyptian architects/builders very readily thought and expressed themselves in terms of cubits and their fractions. . . . Measurements were a form of language. Cubit notation was the principal means of communication to craftsmen in what we ourselves have come to consider to be a mode that is essentially visual. *Architects made sketches or finished drawings which communicated the overall form of a building*, or some of its parts, but dimensionality was conveyed essentially by cubit figures themselves. One can develop the argument that a good builder or architect was one who had this facility to conceptualize from figures. Surrounded by abundant examples of architecture from the present and the past, all in a distinctive homogeneous tradition, he would absorb the vocabulary of detailing and would be able to fill out the broad cubit-based shape appropriately, by-passing the modern need to draw to scale. . . .[104]

Kemp and Rose have offered the latest round of conjectures on ancient Egyptian architectural design. The architects, in their view, thought out "dimensions and proportions directly in terms of cubit measurements . . . [and] reveal a mode of thinking and a process of *ad hoc* working" that has grown unfamiliar to us.[105] Still, in all this there is some consensus that there were canons of proportion for building, whether pyramids, tombs, valley temples, or multicolumned temples in Egypt. What remains to be shown persuasively is precisely what those canons were.[106]

The design techniques for the Greek architects seem remarkably similar. Coulton, Lawrence, and Tomlinson argue, in broad agreement, that the Greeks did not make scale drawings nor did they use scale models in order to undertake successfully their constructions. Instead, the general consensus is that they appealed to rules of proportion and this is why they did not require scale models. How are we to understand these rules? How are we to suppose that they came up with this general strategy? The discussion about the evolution of this strategy is still not clear except for the allusion to Egyptian architecture; the idea of these rules, however, is much clearer.[107] Let us consider the arguments.

Coulton conjectures that archaic building projects were likely handled differently from the ones about which we know more in the classical period. He supposes that these earlier projects were more likely funded by aristocratic (and tyrannical) individuals and families, as patrons and supervisors, since the poleis before the fifth/fourth centuries were not sufficiently organized to orchestrate such detailed enterprises.[108] With regard to the Doric temples, Coulton offered the view that "[t]he proportion for the stylobate was given directly by the number of columns, so that if a temple was to have 6 × 16 columns the desired stylobate width was divided by 6 and multiplied by 16 to find the appropriate length (or vice versa if the length was specified initially). This would give uniform column spacing all around if the stylobate projected half an intercolumniation beyond the axis of the colonnades."[109] Thus, either the patron called out the number of columns—after a decision was made about the lower diameter of a column and the spacing between them—and so the size of the stylobate was reckoned by successive addition, or the patron might have requested a temple to be built of a certain sized stylobate and then the number of columns that could be accommodated on it would have been calculated by successive division. In the Ionic temples the matter was complicated by the fact that the intercolumniation was not uniform though the general strategy seems to be the same. What seem to be different are the specific proportional rules, then, not the strategy of designing by means of appeal to them. In both the archaic Heraion and Artemision, the spacing between the two central columns on the front facade was largest, while the spacing decreased toward each side, and diminished even further along the sides where the smaller unit of intercolumniation became uniform for each flank. More specifically, at the archaic Samian Heraion the front of the temple had an unprecedented two rows of eight columns. Their spacing was graduated to emphasize the entrance by a wider intercolumniation, which as Lawrence put it, "[was the very technique by which] . . . the Egyptians habitually designed the halls and temples . . . and the idea of massing great numbers of columns may also have been inspired by knowledge of Egypt."[110] The spacing between the central columns was about 8.5 meters, axis to axis, but the next pair of columns on either side had an intercolumniation of only slightly more than 7 meters, while the two outermost pairs of columns were separated by a smaller increment of roughly 5 meters. In each case, the diameter of the columns decreased as did the intercolumniation. In the archaic Ephesian Artemisian, the same pattern is repeated though the exact numbers differ slightly. The spacings between the columns on the front facade decreased from 8.5 meters for the central pair, to slightly more than 7 meters for the next pair, and then to roughly 6 meters for the two outermost pairs; the column diameters also decreased from almost 2 meters for the central columns, then by about 13cm, then by 15cm, and finally by 2.5cm respectively.[111] Thus, the rules of proportion seemed to differ in small strategies from the Doric temples of the mainland to the Ionic temples of eastern Greece. The Doric tended to follow routinely the modular system by which a single element was defined and all other measurements were reckoned as additions, subtractions, multiplications, or divisions of it. The Ionic tended to follow it also; however, sometimes the Ionic temples followed a slightly different design technique in which a basic element was decided upon and then each successive measure became a consequence of it, so that the entablature size might not be a whole number proportion of the lower column diameter, but rather its size might be reckoned by the dimensions of the architrave whose size, in turn, depended upon the column height which itself was a consequence of the lower diameter. Both systems worked by different applications of the same technique of proportional rules that apparently made scale drawings and scale models unnecessary.[112]

So far we have considered how the idea of the rules of proportion was formulated by appeal to the ground plan where the evidence for the surviving stylobate and column bases tends to be clearest. But how do these rules of proportion supposedly work when the excavators try to reconstruct the column heights when not a single one that belongs to the archaic period is still standing in Ionia? The excavators appeal to a kind of coherence argument. From the surviving bases, drums, and pieces, the column height is conjectured, since the lower column diameter is calculated to be a proportion of the extended whole, according to a rule. We owe this theory to the reports given by Vitruvius in Book III, chapters 3 and 5, in the *Ten Books on Architecture*, and the reports of Pliny in his *Natural Histories* 36.21 and 36.56. Vitruvius explicitly discusses rules of proportion for columns and interspacings, and then bases, capitals, and entablature in the Ionic order; Pliny also reports on proportional rules. Coulton supposed, as do Wesenberg and others, that just these sorts of rules would have been presented in the early books by the archaic architects.[113] In Book III, chapter 3, Vitruvius tells us that when the temples were planned, one part would be singled out and serve as the module: the usual module in Ionic architecture was the lower column diameter.[114]

Thus, the excavators measure the drum bases, drums, and pieces, and the surviving capitals (or their reconstructions), to (roughly) confirm their conjectures about the specific rules in use, temple to temple, Doric or Ionic. Since the size of the capital stands under a proportional rule, given the lower diameter of the column, the capital, too, can lend confirmation to conjectures about column height. Such reasoning allowed the German excavators such as Reuther in Samos, Bammer in Ephesus, and Gruben in Didyma to venture a guess about archaic column heights of 15–19 meters based upon the diameters and heights of surviving bases, drums, and fragments, the calculation of the lower and upper diameter of the column, the size of the capital, and, most especially, the intercolumniations, since this evidence was often best preserved. Gruben also appealed to the fluting and its projected contours to offer yet another test of the conjectured proportions. These considerations formed the basis for the excavators' conjectures in the absence not only of so much evidence but also of any standing column datable to the archaic period at these sites. The theory of proportions has been supported since the early part of this century in one form or other by important architectural historians such as Dinsmoor and Robertson.

What precisely was the rule of proportion for column height in the archaic temples of Ionia? For some time now, architectural historians and excavators had concluded that the rule of proportion was 10; the height of the column was roughly ten times the lower column diameter.[115] Could the column height, which for Homer and Hesiod separated heaven from earth, be reckoned in terms of a Hesiodic formula of 9 + 1?[116] Column height, Gruben pointed out, could not be determined alone from the lower and upper column diameter and the size of the capital, as was usual in Doric temples.[117] Since no archaic column was standing in Ionia, Gruben argued for the importance of analogy. With one exception, however, there is no analogy, that exception being the Naxian columns in Delphi; their slenderness seems to be slightly at odds with the reports by both Vitruvius and Pliny.[118] The height of the Naxian columns is 10.75 times the lower diameter. The thesis by which Gruben worked in his study of the Didymaion, which is embraced also by Reuther and Walter in the Heraion,[119] and Bammer in the Artemision,[120] is that the construction of archaic columns were guided by a rule of proportion whereby the column height was roughly ten times the lower diameter of the column. While the central columns had a larger diameter, but presumably were the same height of the other columns in the same peristyle if they were to carry the same roof, then they would have stood in a smaller proportion of the height than would the columns with a smaller diameter. Thus, it is difficult to say exactly what the rule of proportion was, but according to Gruben in his 1963 study, it varied from 10.1 to 12.7 times the lower column diameter. With the general proportional rule in Ionia that the column height was (roughly) ten times the lower diameter, Reuther conjectured a column height of roughly 18.9 meters for the Samian Dipteros I based upon the determination that the diameter of the lower drums was roughly 1.896 meters.[121] And Gruben conjectured, following Krischen, that the column height at the Artemisian was roughly 19.8 meters when the lower diameter of the bases was roughly 1.978; and in the Didymaion, a height of 15.45 meters is supposed on the same rule of proportion when he determined that the average lower diameter of the columns was 1.369 meters.[122]

An earlier excavator, Hogarth, conjectured that the column height in the Artemision was 12.6 meters rather than the 18.9 conjectured by Krischen and Gruben, although all agree that the lower diameter is 1.978 meters. Hogarth's conjecture was based upon a significantly smaller proportion rule that he inferred from Pliny and Vitruvius. But Gruben's reasoning overturned Hogarth's: "If Chersiphron could say that a section of the lower part of the column was 1/8 of the height, this applied only to columns that were the same size throughout the entire perisitasis . . . the column height was thus 8 × 4 1/2 Ells = 36 [Samian] Ells. And this is, not coincidentally, exactly the same proportion arrived at by Kirschen by other means. . . . Thus, column height is 12.7 to 10.1 lower diameters; the normal columns of the longitudinal sides are exactly 12 lower diameters in height."[123] Reuther had already come to the same conclusion some six years earlier when he wrote that "[t]he Ionic column normally has a lower diameter that is 1/10 of its height. The lower diameter can only be measured by the standing column and is 1.896 meters. Its height must have been 18.96 meters which would add up to almost exactly 36 Samian Ells."[124] So for a while, it appeared that the consensus had finally been formed, namely, that the rule of proportion for column height in archaic Ionia was ten times the lower diameter.

Wesenberg challenged this thesis in a detailed study in 1983 that suggested the proportional rule was arguably 9:1, not 10:1.[125] He noted that both Pliny and Vitruvius make claims about the Ionic proportions, though there is some difficulty in being certain whether their pronouncements apply to the *archaic* temples. In one passage, Pliny avers that the column height of the archaic Artemision was eight times the column diameter, though both he and Vitruvius also suggest proportions roughly 9:1; in fact, Vitruvius explicitly mentions the proportions 9.5 : 1.[126]

Yet another, much newer study by Gruben, however, calls into question his own earlier assessment of the proportional rule. The excavators seem no longer able to confidently declare that the rule of proportion is ten times the lower diameter. After a series of new excavations on the late archaic temple of Sangri, Gruben expressed perplexity over just this matter: "The findings forced us to determine with a shudder . . . that the interior columns were put up in a free and easy manner with height differences greater than one meter, standing side by side at heights 11.1 to 13.3 times the lower diameter. In contrast, the columns on the front, while having the same lower diameter, are shorter by a measure of the height of the architrave and frieze, and have a height of 8.2 times the lower diameter. Thus, there are glaring differences in proportion of over 50% casually brought together in the same building. Where do we find a 'canon' here?"[127] And Schneider has begun to suspect that we might find a similar result—more complexly differentiated rules—at the archaic Didymaion as a result of the new excavations there.[128] Thus, while the consensus is still very much that there were rules of proportion, there is also new debate and new uncertainty about the specific rules.

Regardless of which particular assessment we are inclined to champion, an important general observation can be made. The general consensus suggests, despite the discrepancies, that there was a proportional technique operating in the Ionic temple constructions, that a key to the proportional rule was a module, that the fundamental architectural module was the lower column diameter, and that the specific rule for column height—the height that for Homer and Hesiod separated heaven from the earth—was nine or ten times the lower diameter. For Hesiod, that cosmic distance was reckoned in terms of a falling anvil. The anvil would fall nine days and reach the earth on the tenth—9 + 1 anvil days. As we shall explore in chapter 4, Anaximander's cosmos is reckoned in terms of a module that just so happens to be explicitly identified with column diameter, and the distances to the stars, moon, and sun are multiples of 9 to 10 of these modular units.

The work of the excavators also allows us to draw a very definite conclusion about the importance of column-drum size, which the fragmentary evidence makes clear varied considerably at all the sites, and from site to site. The specific size of the column-drum seems to be architecturally insignificant to the determination of column height, since that calculation depended upon the lower column diameter and not the size of the parts that would constitute it. Drums were quarried in a variety of sizes ranging broadly in ratios of 3:1, 4:1, and even 5:1. The architect seems to have been concerned about restrictions in this domain only insofar as it made his work more or less tolerable. Drums that were greater than 5:1, as their absence suggests, posed a problem since the number needed to achieve a height of nine or ten times the diameter required the production of many more drums and this was likely undesirable in terms of costly man hours; drums less than 3:1 also seemed to pose a problem, as their rarity shows, and perhaps the difficulties associated with them concerned both delivery to the site and installation. Thus, the variation in drum size showed that these archaic communities were familiar with a range of sizes that, piece by piece, contributed to the central architectural feature of the Greek temple: the column and colonnade. What can we conclude from these considerations?

First of all, the rule of proportion was more central than the specific assignments of measure. Each architect could choose (within a range) his specific lower column diameter, and intercolumn spacing; then, he would apply the rule in order to determine the appropriate column height, and modify it as was fitting. The principle seems to be that once the size of a central architectural element was determined—the module—a proportional rule would be applied to determine the completed size. The height of both the Doric and the Ionic column seems to have been reckoned as a proportion of the lower column diameter, even if the Doric rule was to make column height roughly six times the diameter while the Ionic rule was roughly nine or ten times.

In any event, archaic Ionia offers us a rare blend of individuality and originality still tethered to traditions. The architects in Ephesus, for example, had different sized drums and different numbers of columns standing at different distances apart and at different heights in their temple, proving that they did not simply copy the earlier and contemporary efforts in Didyma and Samos. The Artemision was made entirely of marble, while the early monumental Didymaion and Dipteros I temples were made principally of poros and limestone. They did share fundamental rules, perhaps like Homeric formulae, which they modified when it suited their particular purposes, even if we are still unsure of precisely what those specific rules were. Analogously, as we shall see, Anaximander did not simply copy the architects any more than the architects copied one another. But, when we review Anaximander's reckoning of the size of the cosmos in earthly proportions—that is, column-drum proportions establishing the column's diameter as his module, and the distances to the stars, moon, and sun in increments of 9/10 modular units—we have arguably an example of precisely this architectural technique.

## The Techniques of *Anathyrōsis* and *Empolion*

Anaximander identified the shape and size of the earth with a column-drum. It is quite surprising that in the numerous articles and books that have been written on him, no study appears to have investigated the techniques of preparing column-drums and no documentation has been undertaken of the innovative techniques in Didyma, Samos, and Ephesus that were introduced to Ionia at precisely the same time that he flourished. Might there be some clue in the architect's preparations that suggested to Anaximander the appropriateness of this image as the central element in the cosmic architecture that he detailed in his book?

Column construction out of drums offers us two avenues to think about influence. On the one hand, there was a technical problem for the architect of how to interface each drum, one with another, so that the column would remain stable; on the other hand, there is the image of a drum, as it could have been found at the building site in the process of being worked, and also as a *paradeigma*. Although, visually speaking, the drum face would have been architecturally insignificant since it would have become invisible once it had been installed in the column construction, its image as it was being worked at the sites might have proven significant to Anaximander. Moreover, if Anaximander took the drum face to be significant, the fact that its design would have become invisible upon installation might have inspired him further, because now the philosopher, drawing on the architectural analogy, would be exposing nature's hidden designs. And since Anaximander's cosmos is reckoned in terms of a column-drum and proportions of it, perhaps there was something in the image of the drum itself that contributed to or somehow confirmed his cosmic imagination.

A chorus of art and architectural historians have regularly traced the inspiration and techniques for the multicolumned temples in archaic Greece to Egypt. Coulton joined the chorus and traced out a plausible account for this transmission and remarks that "Certainly Egyptian architecture would have provided the best model for that Greek architecture later became. . . ."[129] So what about *anathyrōsis*, a modern term that architectural historians have assigned to techniques for fitting together large blocks and column-drums by dressing only the edge, rather than the entire surface, where the blocks meet? Was *anathyrōsis* also imported from Egypt along with so many other techniques that depend on accurately cut megalithic masonry? Or was this technique an invention of the archaic Greeks? According to Coulton, *anathyrōsis* "does *not* occur in Egypt or the Bronze Age architecture of Greece. In Egypt both horizontal and vertical joint faces were normally dressed accurately to a plane, so that adjacent blocks made contact over the whole of each joint face."[130] It happens that on this particular issue Coulton was mistaken; while it is true that the interfaces of large blocks are usually dressed to a plane, we have Egyptian evidence of *anathyrōsis* on large blocks and column-drums dating back to the Old Kingdom. The question of whether the Greeks of the late seventh century in Olympia and Kerkyra, and at Didyma, came up with the idea themselves or rather imported it from Egypt must remain open. But the evidence now shows that the Greeks certainly could have gotten it from Egypt where it was not infrequently used.

The case for the Egyptian technique was made most recently by Arnold. He described the technique and its Egyptian origins: "Another labor-saving method to obtain accurate joining of blocks had been invented in the Old Kingdom—*anathyrōsis*, later a common feature in Greek architecture. Contact was not achieved over the whole surface but only along a contact band at the front edge, while the center of the joint face was left rough and slightly concave."[131] Arnold identifies the evidence for *anathyrōsis* on large rectangular blocks in the Middle Kingdom temple of Mentuhotep-Nebhebidre in Deir el-Bahari[132] and acknowledges Winlock's earlier study where the technique was identified at the temple of Hibis in the el-

Khargeh Oasis.[133] At the treasury of Thutmosis I at Karnak, Arnold identified the technique of *anathyrōsis* early in the New Kingdom. Below are his reconstruction illustrations:[134]

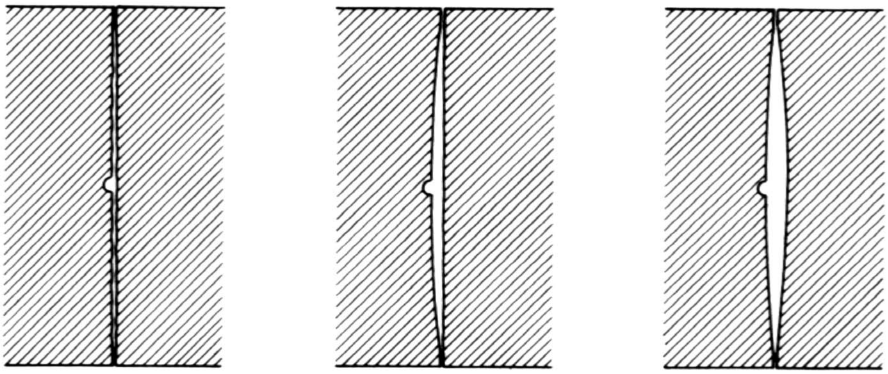


*Figure 3.19*

*New Kingdom* anathyrōsis *on vertical joints, treasury of Thutmosis, Karnak*

More surprising still, Arnold identified the use of the technique on column bases as early as the Old Kingdom. In this case, on the following page, at the mortuary temple of Queen Djedkara Isesi of the fifth dynasty and almost certainly before 2300 BCE, the column base exhibits *anathyrōsis* and was dressed from a block too small to cover the whole base.[135] Although weathered, the smooth band can still be seen running around the circumference of the column base (figure 3.20).

In Greece, we have evidence for the adoption of this technique dating to the late seventh and early sixth centuries. The term *anathyrōsis* derives its name because its effect is something like the frame of a door (*thyra*).[136] In the development of stone construction the technique was first employed on the vertical faces between two blocks.[137] While the horizontal faces were customarily completely dressed to a plane, the vertical faces could fit well without dressing the entire surface.[138] This, of course, proved

*Figure 3.20*

*Old Kingdom* anathyrōsis*, column base, mortuary temple of Queen Djedkara Isesi*

to be a labor-saving technique. But, as the building projects became increasingly monumental, this procedure of *edge anathyrōsis* proved to be inadequate. The solution to the problem introduced by the use of increasingly massive stones was to dress the vertical sides with a band around all the edges, not just the top and side, and this technique came to be known as *band anathyrōsis*. The illustration of this technique, after Coulton, appears below.[139]

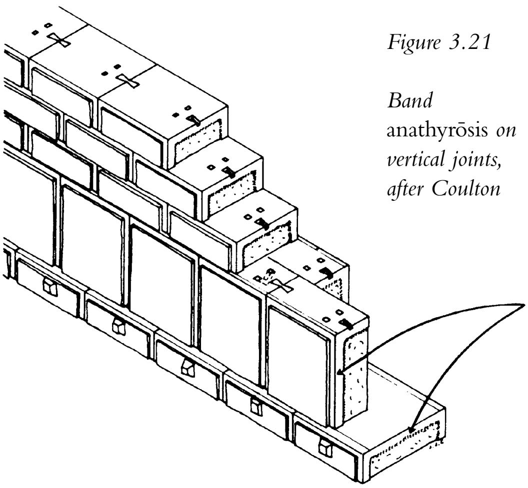


*Figure 3.21*

*Band* anathyrōsis *on vertical joints, after Coulton*

Nylander was among the first to have shown that this same technique was already applied to column bases in the mid-seventh century. The column bases displayed a smooth band running around the circumference of the base while the rest of the horizontal drum face was chiseled so that it was slightly concave. Below, an early example from Dreros in Crete.[140]

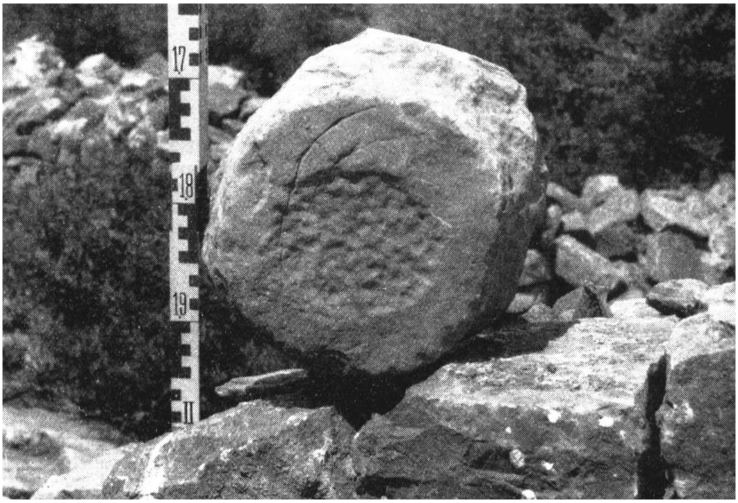


*Figure 3.22*

*Early example of column-drum* anathyrōsis *from Dreros, Crete*

When the technique of *band anathyrōsis* is applied to column-drums and bases, both interfacing horizontal surfaces are identically prepared.[141] When the outside lip of the drum is carved smooth and the interior surface is chiselled out, making it concave to ensure that there will be no contact except on the circumference band, additional concentric lines often appear on drum faces creating the appearance of tree rings in the stone, which had replaced the trees that were the usual supports for the roof in earlier constructions. The purpose of these rings on the drum face is to divide the surface into geometrically precise regions that serve as guides for the masons' efforts. This is crucial because the success of the architectural technique required the determination of the center of each drum in order to ensure that the circumference of each drum was precisely equidistant from the center and so would interface the next drum exactly. To be certain of the exact center, and consequently the circumference, one or two concentric lines often appear on the drum face, in addition to the *band anathyrōsis* on the circumference that often appears as a third ring. The *anathyrōsis* technique, on column-drums and bases, is presented in this reconstructed example, after Orlandos. This one is fluted.[142]

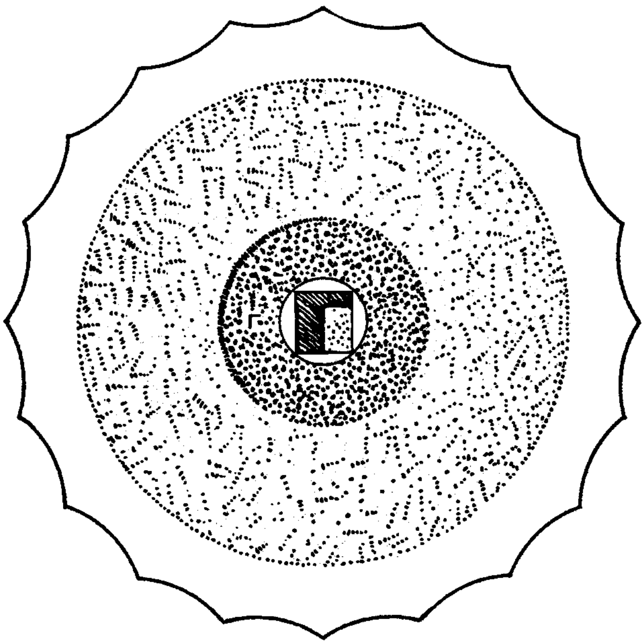


*Figure 3.23*

Anathyrōsis *technique displayed on a fluted column base, after Orlandos*

Determining the exact center of the drum is crucial for the success of this technique, for the architect must be able to instruct the mason of the exact measure of the *band anathyrōsis* that runs around the drum's circumference. By means of a caliper or compass, once the center has been determined, the *band anathyrōsis* can be measured and produced. To express this result and serve yet another purpose, in the precise center of each drum a hole is made for a device called the *empolion*.[143] The *empolion* is most often a squared dowel whose purpose is to secure the proper fit of the new drum to the base or drum already in place; thus, at the center of each drum is a square or rectangular hole to accommodate the *empolion*. It so happens, however, that the *empolion* was at times not squared but rather circular as suggested unmistakably by the round holes in the column-drums from the archaic Didymaion.[144] In any event, whether they were squared, rectangular, or circular, as the new drum was lowered into place, the dowel lined up both drums by connecting them in the center.[145] This technique enabled the new drum to be set without chipping the edges when the massive stone was lowered into place. The *empolion*, then, also provided a means for centering the new drum on the one already in place so as to diminish the possibility of one drum's sliding, that is, moving laterally. Below is an illustration of the *empolion*, after Orlandos.

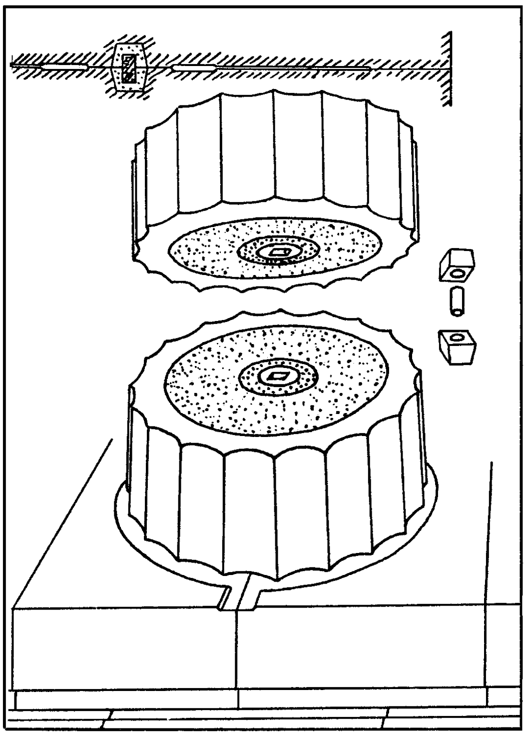


*Figure 3.24*

Empolion *and* anathyrōsis *technique, on fluted column, after Orlandos*

Among the earliest evidence for column-drum *anathyrōsis* in Greece, we have examples from Naxos. At the temple of Iria, datable to the early sixth century, Lambrinoudakis and Gruben identified the use of *anathyrōsis* on rectangular blocks and drums.[146] Contemporaneous, and perhaps slightly earlier, we have evidence of drum *anathyrōsis* from the archaic temple of Apollo at Didyma, dating to the late seventh or early sixth century. These early drums were made of local poros stone, not marble as was long supposed for the first monumental stone temple there.[147] Different techniques were apparently employed for the *empolion* but in what follows, two examples are displayed, the first an actual surviving archaic drum that displays (weathered) *anathyrōsis* and whose dimensions are 3.4 : 1 (figure 3.25), and a reconstruction drawing from a surviving drum piece that displays *anathyrōsis* clearly and also a round *empolion* (figure 3.26).[148]

*Figure 3.25*

*Archaic column-drum, roughly 3.4 : 1, Temple of Apollo, Didyma*

By the most recent dating, the first stone monumental temple to Hera in Samos, Dipteros I, made mostly from local limestone, is placed circa 575 BCE; the so-called Theodorus temple.

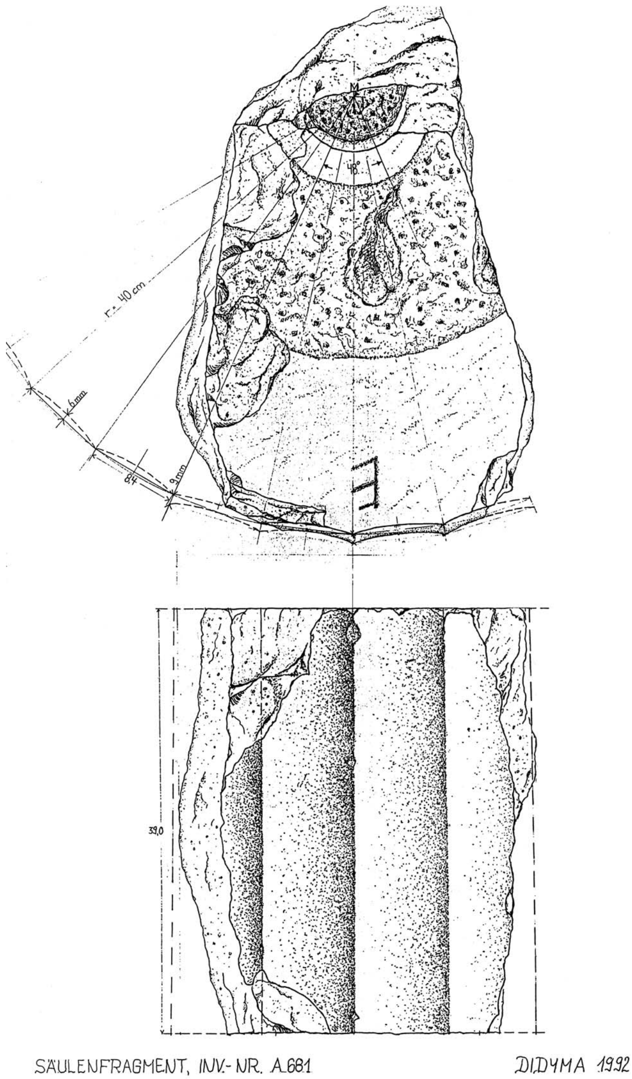



*Figure 3.26*

*Archaic column-drum reconstruction, with round* empolion, *Temple of Apollo, Didyma*

The dating is fixed by appeal to pottery found buried just below the foundation. Evidence for drum *anathyrōsis* has been positively identified since the early excavation report by Buschor. One of the reasons that any drums survive at all from Dipteros I is that they were reused, in this case as part of the northern foundation wall. Below, following Buschor, we have a Rhoikan drum and a reconstruction drawing illustrating the *anathyrōsis* and identifying its dimensions, roughly 3.9 : 1.[149]

*Figure 3.27*

*Archaic column-drum, with fluting, Dipteros I, Samian Heraion*

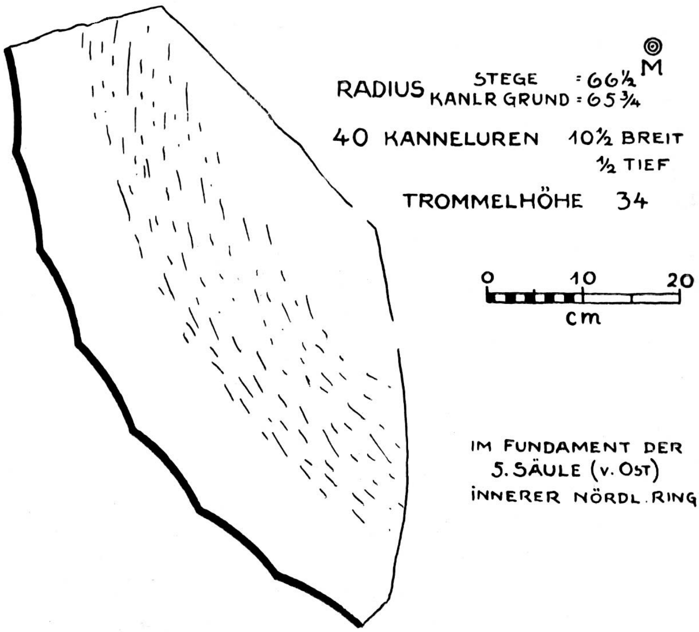



*Figure 3.28*

*Reconstruction of archaic column-drum showing* anathyrōsis*, Dipteros I, Samian Heraion*

We also have Dipteros I drum bases that exhibit *anathyrōsis*. Although weathered, we can still be sure that the technique was applied.[150]

*Figure 3.29*

*Archaic drum bases displaying* anathyrōsis*, Dipteros I, Samian Heraion*

Other fine examples also survive from the Samian Heraion and belonging to the sixth century. The drum on the following page is from Dipteros II, the so-called Rhoikan temple, that is the temple of Hera rebuilt after its destruction around 540 BCE. Thus, this drum offers evidence from roughly the second half of the sixth century and confirms the regular use of drum *anathyrōsis* in sixth-century monumental architecture (figure 3.30).[151]

Not only on drums, but on other stonework, the technique of *anathyrōsis* was the architect's choice when a large block had to fit securely upon another stone surface. Kienast has shown that the statue bases of the so-called Geneleos group, at the entrance to the sanctuary, were all provided with the *anathyrōsis* technique.[152] And we also have such evidence from the other stone colossus, the marble temple of Artemis at Ephesus, one of the seven wonders of the ancient world. Many blocks, now in

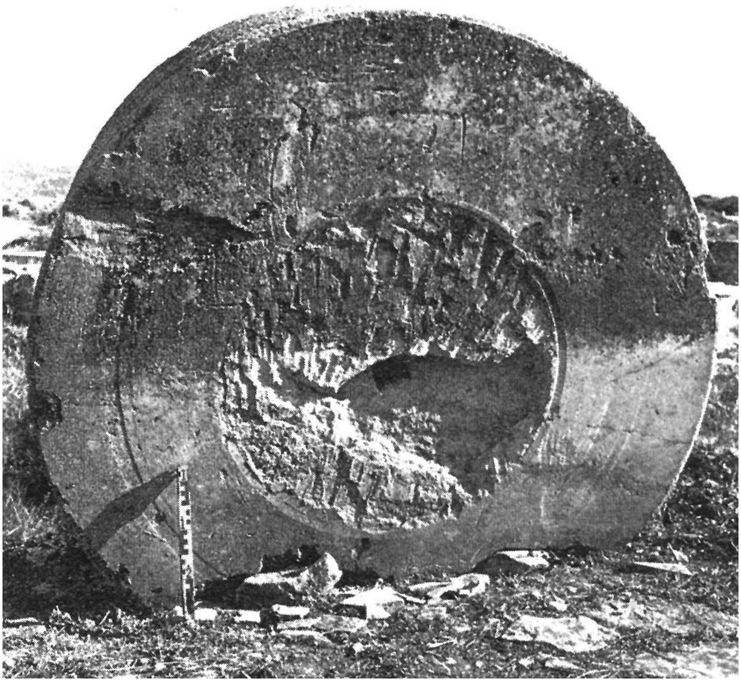


*Figure 3.30*

*Archaic column-drum displaying* anathyrōsis*, Dipteros II, Samian Heraion*

the British Museum from the so-called Kroisos temple, that is, dating from the mid-sixth century, display *anathyrōsis*.[153] Furthermore, in keeping within the usual practice, not surprisingly, we have evidence of drum *anathyrōsis* from this Kroisos temple, pictured on the opposite page.[154]

What can we conclude from our discussion of *anathyrōsis* and *empolion*? First of all, we can conclude that the technique of *anathyrōsis* was not a Greek invention, and in all probability was among the building techniques that the Greeks imported from Egypt. The Egyptian evidence confirms that the technique of *anathyrōsis* had a long history dating back to the Old Kingdom when it was used on column bases, and then in evidence in the Middle Kingdom, New Kingdom, and Late Kingdom monumental architecture. For the Greeks, there is evidence from the mainland, the islands, and eastern Greece, of edge and band

*Figure 3.31*

*Archaic column-drum displaying* anathyrōsis*, Temple of Artemis, Ephesus*

*anathyrōsis* dating from the seventh century. The band *anathyrōsis* on column-drums and bases shows that certainly by the first quarter of the sixth century BCE, when Anaximander was flourishing, the architects working in his own backyard in Didyma were preparing column-drums by carefully carving the circumference of the horizontal drum face, having carefully determined the precise center of the drum. By means of a caliper or compass, the outside and inside measurements would have been made for a band tracing out a concentric circle around the drum's circumference. The architects supervised the workmen who made holes in the middle of the drum, sometimes circular, for the *empolion* and who then chiselled out the region between the smooth band and the center hole so that most of the surface was made concave. And this technique of *anathyrōsis* was routine not only in the preparation of column-drums at the archaic temples of Apollo in Didyma, Artemis in Ephesus, and Hera in Samos, but also for other large blocks—circular, rectangular, or even irregular as suited the sculptor. To begin to appreciate the kind of impact that the image of column-drum *anathyrōsis* might have had on Anaximander and his community, we must recall that column-drum construction was itself an innovation at just this time when monolithic columns were replaced by drum construction as the demand grew for increasing monumentality. The single-stone columns were replaced by drums that could be more easily quarried, more easily transported to the building site, and more easily installed. However, this solution brought with it a new technical problem, namely, how to ensure the vertical and horizontal fixity of the column when ten or more drums would be placed one upon another to reach the great heights that the architects required, and still carry the enormous load of the architrave and entablature above. This new problem was met with a new solution—the techniques of *anathyrōsis* and *empolion.* By means of them, the architects answered the question of how to make each drum sufficiently stable so that it would not move sideways and fall, and how to make each column so stable as not to collapse under its own weight, as each new load was placed upon it. When Anaximander reached the conclusion, according to Aristotle, that the earth remained motionless in the center of the cosmos, supported by nothing, he too wrestled with the question of how the heavy earth achieved vertical and horizontal fixity. Could the techniques of *anathyrōsis* and *empolion* have offered him, by some sort of analogy, an avenue to think through cosmic architecture?

# 4

# *Anaximander's Techniques*

## Architect, Philosopher, and the New Vision Supplied by the Application of Geometrical Techniques

> It would be hopeless to draw a diagram to accompany such a description [of Hesiod's cosmogony]. The poetic Tartarus is vividly and dramatically conceived. A diagram, however, requires not drama but a precise geometric arrangement and nothing could be more alien to the poet's state of mind when describing such mysterious regions. It is on the other hand, the characteristic feature of Anaximander's view of the earth that it lends itself directly to geometric representation. We can scarcely doubt that the Milesians were in fact accustomed to discuss such matters with the aid of diagrams or simple models. And in Ionia, at any rate, the standard model of the earth remained that of Anaximander until the time of Democritus.
>
> —Charles Kahn,
> *Anaximander and the Origins of Greek Cosmology*

Charles Kahn in his classic study offered us a view of Anaximander's achievement. According to Kahn, Anaximander, unlike his predecessors, provided a vision of the universe whose organization is revealed by geometry;[1] the universe has an order, mortals can come to know it, and that order is fundamentally geometrical. Anaximander invited us to a vision of the "big picture," the ultimate physical context in which our lives find a place, and that context is revealed by geometrical or mathematical relations. Whereas the vision of that ultimate context according to Hesiod defies a detailed and precise geometrical representation, the decisive and uniquely innovative fact about Anaximander, according to Kahn, was a universe that lent itself to geometric representation.

The importance of the role of models in Anaximander's thought was rightly emphasized in Sambursky's study, published a few years earlier than Kahn's.[2] Sambursky identified Anaximander as the first to make use of the "scientific model" as a means of description or as a method of explaining phenomena.[3] In matters of cosmology, Anaximander's model stands at the beginning of a process whose culmination includes a modern globe and a planetarium; it offers a model, at least roughly to scale, of cosmic dimensions in such a way that the whole and its parts can be conveniently studied. Thus, Sambursky, like Kahn, rightly drew our attention to the importance for Anaximander of techniques in other fields to illustrate philosophical conceptions: "These two models—the revolving wheels and the fire appearing at the mouth of the forge—are perfect examples of technical analogy. They enable us to form some faint conception of the tremendous revolution in thought which took place in sixth century Miletus."[4] What they and others missed were the techniques of the architects on which Anaximander relied.

One important way to understand Anaximander's innovative achievement in thinking about the structure of the universe is to grasp that he geometrized it. This means that he applied geometrical techniques to astronomical events in order to illuminate their regularities.[5] There can be little doubt that Anaximander's motivation was not inspired by observational techniques.[6] Rather, a variety of applied geometrical techniques, however rudimentary its formal presentation, and most especially the architects' rules of proportions, served as a central ingredient in his inspiration, for by means of them a vision of heavenly order and the human capacity—the rationality—to discover it were made accessible to him.

Anaximander's model making was facilitated by his geometrical conception of the universe and must be seen within a context in which technological development and gadgetry assumed a prized place.[7] His cosmic model, unlike the earlier and contemporaneous allegorical and mythological fancies, provided a prime example of what Burkert aptly described as a central feature of sixth-century Greece: geometry was in its heyday.[8] But this geometrical proclivity, especially in its proportionate applications, was no less true for the architects. On the one hand, technological developments were transforming archaic society in part by inviting archaic Greeks to think of their world as a great machine which could be manipulated mechanically as did the architects with temple building. On the other hand, the geometric applications[9] that fascinated Anaximander allowed him to think through cosmology in a fashion distinct from his predecessors, freed from the bonds of those mentalities encased by the hexameter of Homer and Hesiod.[10] Let us reflect on this cultural transition.

For Homer and Hesiod, the gods excel over mortals in three primary respects. They surpass human beings in strength, beauty, and longevity. They do not surpass mortals in what Plato later came to regard as moral virtues; thus, gods and goddesses provided a horizon of meanings in terms of which human beings found a place. That place was far inferior to the deities in power and in visual appearance; moreover, it was radically separated by the unfathomable abyss of its intrinsic mortality. It was thus against a horizon of divine immortality that mortals ultimately discovered their nature and hence their place. While some could become stronger, as the Olympic games attested, and some could become more beautiful, as changes in styles and apparel suggested, none could escape mortality.

Seen against this horizon, geometrical thought appears as a peculiar grasping of and sharing in eternity. Geometrical knowledge is unlike our acquaintance with everything else that we see, hear, touch, taste, and smell—the objects of our senses—for those mathematical objects—forms and patterns—do not change. The rise of Greek philosophy in the persons of Thales and Anaximander, and later Pythagoras, is in large measure the story of the rise of this new geometrical thought with its new language and peculiar objects, and the new horizon of the capacity of human knowing that it opened. So far as human beings had the capacity to glimpse into and take a share of the timeless, geometric thought was a new vehicle to that domain. Indeed, this was the very power of the geometric vision for it allowed Anaximander to move into a new region of rationalistic *prosaic* explanations, away from the epic discourses and mythological constraints that both liberated and shackled Homer and Hesiod in singing their songs. The architects, along with the Milesian *phusiologoi*, were no doubt stunned by their discoveries of geometric thought and its curious application to a world of change, a world grasped first of all by the senses. The imposition of certain patterns on physical things allowed them to become intelligible in a manner previously unknown. No doubt it was partly an inherited wisdom, from Egypt, Babylon, and elsewhere, but the archaic Greeks in Ionia transformed that vision and so also its meaning. The idea that the world has a highly defined order, an order that defies mythological constraints, and that mortals could come to know it, has been widely attributed to the innovative mentality of Thales and Anaximander.[11] Such an attribution is fitting, as it was for the Egyptians before Thales, because these thinkers found in geometry their model—their reason—for affirming a vision of a highly articulate universal order. The relations established by geometry are timeless, unlike social relations, which are forever vulnerable to change. This vision of relations that remain forever the same was decisively unlike any other domain of articulated social relations of which these archaic Greeks knew. But methodologically speaking, it made use of the same structure of theological relations that were familiar from traditional religion: the eternal (deities or geometrical objects) found application in the domain of change and mortality. Moreover, the pursuit of a perceived world order by Thales and Anaximander revealed a new optimistic background, that nature had an exquisite eternal order that could be grasped *in new details* by creatures, miraculously enough, who were not eternal.[12] The fact that they could was *prima facie* evidence of a different kind of divine capacity in mortals, an unexpected and unanticipated discovery delivered by geometrical thought that, with the important exception of prophets like Kalchas and oracles at Delphi and elsewhere, had escaped the notice of their predecessors and compatriots. The reason for their enthusiasm for this vision was their astonished reaction to certain truths of geometry; for in terms of that vision, they believed they had found, as had the Egyptians before them, the order of eternity.

If we think deeply about the claims of Kahn and Sambursky that the fundamental insight into Anaximander's world view is that it lends itself to geometrical representation, a view that was aided and illuminated by models and drawings, we find ourselves with two largely unasked, nonetheless unanswered, questions: (1) from whom in Anaximander's archaic world did he learn the techniques for making models and drawings that can "scarcely be doubted"? and (2) if Anaximander's world view is peculiarly capable of graphic representation by virtue of its geometric dimensions, can we render pictures of it? The answer to the first question about models and drawings is to be found in the efforts of the craftsmen, especially the architects trained in the tradition of house builders and working in his own backyard. In the previous chapter we traced the techniques of the Egyptian architects, their routines of imagining in plan, making drawings and models, and their appeals to some canons of proportion in various artistic creations. Further, we have shown how the Greek architects inspired and influenced by them and their productions employed such techniques. The Greek architects offered a geometrical vision of the divine cosmos by imposing a geometrical order on the house of the eternal: the Greek temple. The answer to the second question is to be supplied in the form of pictorial renderings that seek to reconstruct Anaximander's drawings or models in their geometric character.

The case now being argued is that the techniques of the archaic architects in Ionia contributed to the enterprises of

Anaximander and shared an applied geometrical character. Further, the Ionian *phusiologoi* may have been part of that related itinerant social community or interacted with them. Minimally, the monumental edifices provoked them to think further about nature by means of their techniques. But in any case, the host of problems that faced the architects—of designing, quarrying, transporting, and installing megalithic masonry—cannot be separated from the community so deeply affected by these projects. Their problems, no doubt, would have been known most especially to persons such as Anaximander and Thales, for all the evidence suggests that they were engaged in thinking about problems in applied geometry at the same time and in the very same Ionian world, and might even have been patrons of the projects. According to the report by Herodotus, Thales purportedly diverted the river Halys for the army of Kroisos. Herodotus does not believe it, since he wrongly believed the bridges were already in existence,[13] but he in no way doubts the idea that Thales accompanied Kroisos on his military campaign. Thales was by then in his seventies in 546 BCE when Kroisos met his end at the hands of Cyrus—Anaximander's book was likely "published" in 548–547 BCE—and was brought along not merely to divert the Halys but surely to assist with any problem that might arise for which engineering (and political?) skills would be key. Given this sort of picture, can we really believe that Thales and Anaximander were not frequent visitors and conversants at the building sites in Samos, Ephesus, or their own backyard in Didyma? The argument here is not that *technē* provided a sufficient condition to account for the origins of Greek philosophy but rather that *technē* and the intersection of social communities engaged in it have not been fully appreciated, for they played a seriously underestimated role in motivating Anaximander's geometrical inspiration and thus a more significant role in the origins of philosophy connected with his innovations than they are customarily accorded.

Anaximander's cosmic picture did not emerge *ex nihilo* but rather against a background of efforts to imagine the shape and size of the cosmos. It was the language of geometry that enabled him to step away decisively from his predecessors but these steps gain their significance only against and in light of these earlier efforts, and to them we now turn.

## Homer's World Picture

When one tries to picture the physical world so far as it can be determined from the *Iliad* and *Odyssey*, geometrical proclivities are quickly frustrated, as are any hopes of a direct narrative addressing the issue. But, in the account of Hephaistos's creation of Achilles' shield,[14] Homer offers us a forerunning glimpse into the origins of the natural philosophy with which we tend to identify Anaximander.[15] For in the sequence of Hephaistos's construction we get the clearest conception of the physical world for Homer. Fashioned out of four metals—bronze, tin, gold, silver—the shield represents the world in the series that begins with the earth, then the sky, the sun, the sea, the waxing moon, and the stars. This series bears some resemblance to the cosmogonic series detailed by Hesiod, but it would be a mistake to see cosmogony proper in the construction of the shield.[16] In the *Iliad* passages, Homer only shows us how Hephaistos, working at the forge makes use of twenty bellows to produce so great a heat as to melt the metals and so hammer out the world-as-shield on his great anvil. The world-shield presents a round, flat earth[17] in the center and finally great Ocean running around the outside rim of the shield, that is, its circumference.[18] The idea of the earth as a circular disk covered by the "inverted bowl" of the sky is directly derived from the perception of the horizon (figure 4.1).[19]

We know that Homer knew of Tartaros, for in book 8 of the *Iliad* Zeus warns all the other gods that should any one of them become involved in the fighting of the battle for Troy, he will hurl him into the deepest pit of Tartaros, where there are iron gates and a bronze threshold, as far from Hades as heaven is from earth.[20] This description is as close as Homer comes to

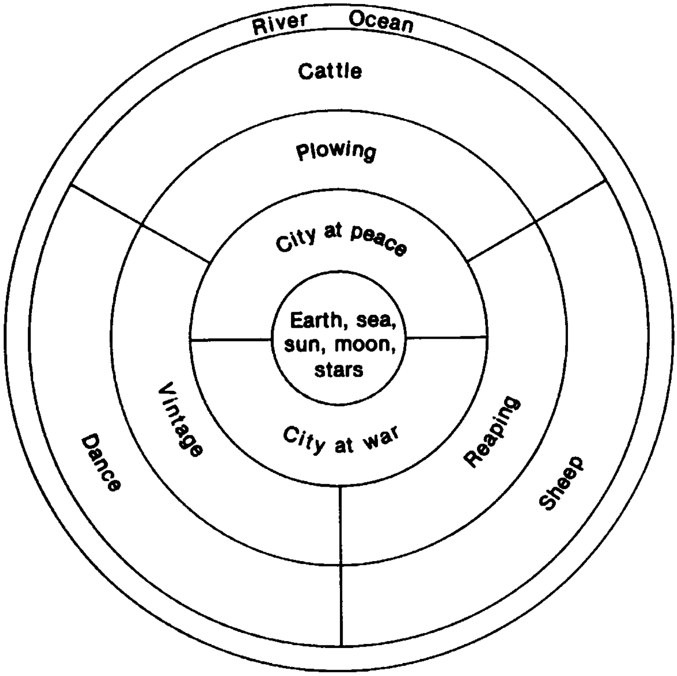



*Figure 4.1*

*Reconstruction drawing: The shield of Achilles from Homer's* Iliad, *after Wilcock*

a symmetrical vision of the cosmos, where "down below" is somehow analogous in distance—not in shape—to "up above."

When we try to imagine Homer's physical world, a dimly lit picture forms. The outlines seem clear enough but the details become confounding. Kirk-Raven offered a description of what they called the "naive view of the world" from scattered references in Homer:

> The sky is a solid hemisphere like a bowl. . . . Solidity as well as brightness is presumably conveyed by . . . metallic epithets. It covers the round flat earth. The lower part between earth and sky, up to and including the clouds, contains aer or mist: the upper part (sometimes called the *ouranos* itself) is aither, the shining upper air, which is sometimes conceived as fiery. Below its surface, the earth stretches downwards, and has its roots in or above Tartarus. . . . Round the edge of the earth-disc, according to the unsophisticated view, flowed the vast river of Okeanos.[21]

The outlines of the Homeric picture seem accessible enough but the details resist visual representation. An understanding is perhaps made clearest by asking what questions seem to be left unasked as well as unanswered in this epic scenario. Precisely how far away are the most distant reaches of the universe? How far below is Tartaros? Just how big is the earth upon which we are standing? The lack of quantitative determinations renders the effort at graphic depiction imprecise.

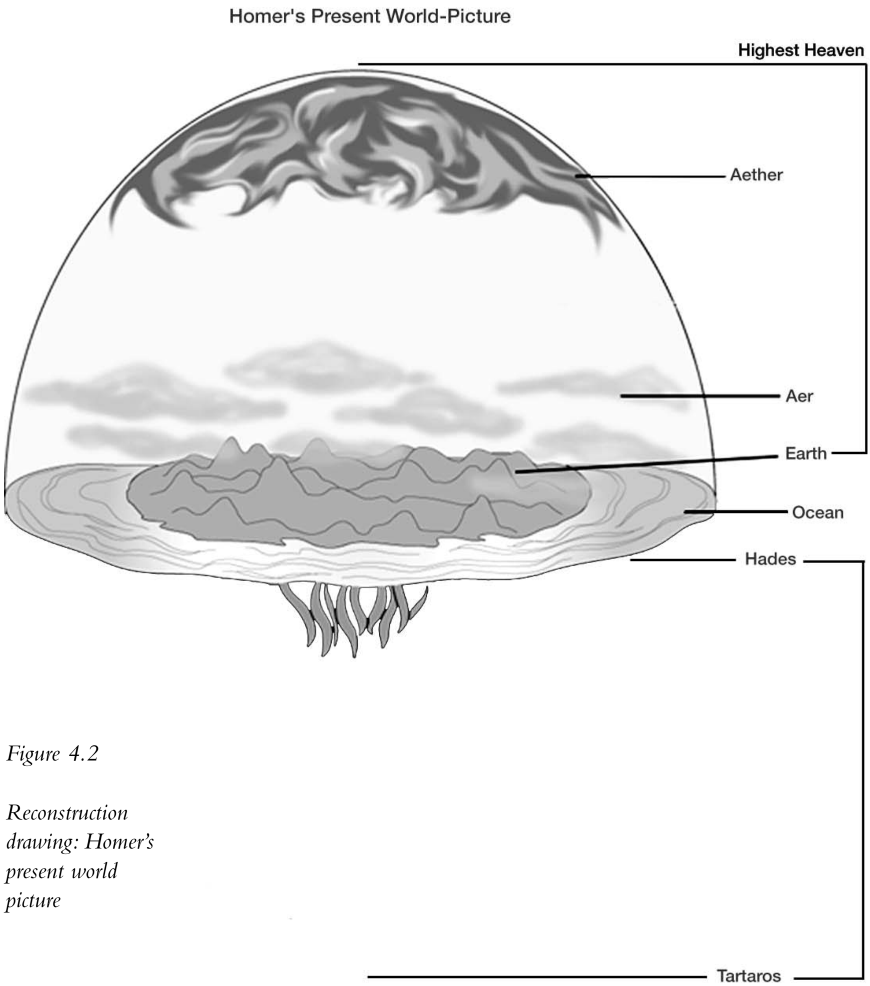



*Figure 4.2*

*Reconstruction drawing: Homer's present world picture*

How shall we account for the important details omitted or simply left unconsidered? There can be no sure answer to such a question. Minimally, it seems that Homer and his contemporaries could not ask such questions in a way that we would find intelligible.[22] Perhaps the early archaic community could not find its way to these questions, or having found their way to them, full of cosmic wonder, they had neither a language nor a technique which would allow them to respond effectively. The introduction and development of geometry and the practical applications of geometrical techniques on grand scales in monumental architecture provided new avenues for precise measurements and their expression in the sixth-century community. The temple, after all, was a model of the cosmic house; the formulation of its precise measurements opened analogously a vehicle for reflecting upon the measurements of the house that is the cosmos. Moreover, in addition to the innovative language brought forth by new geometrical techniques and perspectives, Snell and others have argued that the archaic Greek language was undergoing change in another domain. He suggested that while the earlier poetic language did not facilitate, as did prose, the generic use of the article, new developments in prose expression led progressively to the formation of substantive nouns that served as "stable objects" of philosophical and scientific thought.[23] Homer's poetic discourse, on Snell's account, did not have access to these stable objects revealed prosaically by the generic use of the article.

## Hesiod's World Picture

There are two central ingredients, for our purposes here, that distinguish the world picture ascertainable from Hesiod's *Theogony* from that derivable from Homer. The first is the presence of some quantitative detail that although very far from precise allows us to envision the size of the universe with greater clarity. The second is the *explicit* idea that the universe is "cosmogonized." These points have been made by estimable scholars for more than half a century, though no one appears to have attempted a drawing of it.[24]

First, the size of the universe. How extended are the far reaches of the uppermost heavens? Hesiod takes us back to Hephaistos's workshop, as did Homer, to provide an answer. But unlike Homer, Hesiod does not illustrate the new model in terms of a shield.[25] He tells us that a bronze anvil dropped from the highest reaches would descend nine days and then land on the earth on the tenth day after it was left to fall. And how far downwards do the murky depths of Tartaros descend? Interestingly, Hesiod provides the same symmetrical image in reverse: a bronze anvil falling downward from Earth would fall for nine days and reach the lowermost reaches of Tartaros on the tenth day.[26] No mathematical or astronomical techniques known to Hesiod, either from his own farming or from the blacksmith's shop, could have supplied him with these measurements. The selection of numbers, instead, represents a meaning to his archaic community. What is that symbolic meaning?

Homer, before Hesiod, had called upon this formula, again and again, to signify great amounts of time and great multitudes. In *Iliad* 2, the prophet Kalchas prophesies that the Trojan war will drag on for nine painful years but that the Achaeans will take the city in the tenth.[27] In *Odyssey* 14, we learn that for nine years the sons of the Achaeans fought in Troy, and in the tenth, the city of Priam was sacked.[28] Phoebus Apollo answers Chryse's prayer, rains down arrows for nine days on the Achaean host, and on the tenth day Achilles calls for a meeting.[29] Odysseus's boat was swept along by a hostile wind for nine days, but on the tenth landed in the country of the Lotus-Eaters.[30] Odysseus and his men left the land of Aiolos and sailed for nine days before the land of their fathers appeared on the tenth.[31] After escaping from Charybdis and Skylla, Odysseus was carried along for nine days and reached Ogygia, home of Calypso, on the tenth.[32] Odysseus was nine times the leader of men, and the expedition to Troy was his tenth.[33] The references to a nine-year old ox, nine-year porkers, and nine ships are among the many examples that show that the number "nine" was part of a familiar formula; it connoted great age, time, or multitude.[34] And the formula could be doubled, expressing even more extraordinary increments of time: just as the *Iliad* opens in the ninth year of the Trojan war, anticipating its conclusion in the tenth, so also Odysseus greets his aged dog, Argos, after nineteen years and finally comes home in the twentieth.[35] The basic formula is 9 + 1.

This same formula also found expression in the *Hymn to Demeter*. When the poet wants to indicate to his archaic audience a very great interval of time, or a very great distance, the poet calls upon the number nine.[36] In this symbolic formula, distraught Demeter wanders over the earth for nine days looking for her daughter Persephone, and on the tenth day Hecate finally gives her the news.[37] So also, Hesiod calls upon the same symbolic formula: 9 + 1. He does so to suggest a comparably great duration of time when he refers to those who pour a libation of waters from Styx, eldest daughter of back-flowing Ocean, cut off from councils and feasts for nine full years, finally to join the gods again in the tenth year.[38] And Hesiod uses the same symbolic formula for great intervals of distance: the universe is so great in size that a heavy anvil would fall nine days—a perfectly extraordinary distance is conjured—but the upward heights of the universe, just like its almost imponderable depths, are greater still, 9 + 1.

About the poet's proportions, a different point can be made. The decision to make the extremities of the universe explicitly equidistant expresses the conscious desire to achieve symmetry. The earth that Hesiod stands upon is *en meso*—"in the middle"—between the far reaches above and below. Vlastos, some fifty years ago, saw that Hesiod's symmetry reflected new political ideals that sought, like the developing polis, a town planning that would place the citizens in the middle and with some equal access to power. Just as the speaker in the *Iliad* routinely enters into the center of a circle formed by his peers, takes the scepter and begins to speak,[39] so also human beings find their proper place on the earth surrounded at equal distances from the heavens above and Tartaros below, in the middle.

Second, Hesiod's world picture, unlike Homer's, is cosmogonized. This means that for Hesiod the present state of the cosmos is consciously understood to be not the way it once was in earlier times and at the very beginning. Further, the mentality of the cosmogonist is one that insists that the present world order is comprehensible only against a background of a succession of conditions that precede it. Both Robinson[40] and McKirahan[41] offer a picture of Hesiod's cosmos. The most important deficiency in those otherwise useful representations was that they failed to convey the vision of the successive transformations that brought forth the present world picture and without which the present world picture properly escapes our notice. Unlike Homer, so far as the surviving evidence permits us to infer, Hesiod consciously understood our present condition as a succession of temporally preceding states of affairs.[42] Thus, the attempt to pictorially render Hesiod's model requires not a single picture but a series of images each dependent upon the others.

Hesiod's cosmogony is orchestrated according to two structural principles, distinct but interwoven:[43] (1) the appearance of what is qualitatively specific requires its opposite; and (2) the making of *cosmos*, an organized whole, requires its articulation into parts in order to come-to-be the whole that it is. Thus, Chaos, the "gap" or "yawning space," makes possible the differentiation of Earth and Tartaros, and thus their emergence; so also for Erebos, the dark, and black night as specific domains. Sky emerges as the opposite of Earth, and the whole of sky and Earth joined by ocean come-to-be as the opposite of Tartaros. Further, Earth's next two parthenogenic begettings, the differentiation of itself into hills-and-dales and sea, illustrates the point that the very meaning of being whole requires the articulation of parts.

In order for there to be *cosmos*, an "organized whole," there must be distinct parts that comprise the union. But, in order for there to be distinct parts, there must be separation, the emergence of what is qualitatively specific. Stated in this way, we come to see the dynamism and emerging rationality in Hesiod's cosmogony; still mired within the frames of mythopoetic discourse, Hesiod unfolds for us certain cosmic structures and principles that arise through successive separations and unions and require opposition and contrariety to reveal their specific natures. Seen in this light, his adumbration of Anaximander's cosmic insights is noteworthy.

The several stages certainly admit of various representations and it must be acknowledged that nowhere does Hesiod denumerate the stages into a definite and fixed number of steps, nor do we have precedents ancient or modern to guide the effort to make representations. According to the illustrative rendering presented here we have the following stages:[44]

(1) First of all came-to-be Chaos, a gap or yawning space;
(2) With this opening, Earth and Tartaros appear;
(3) The whole Sky (and Earth) emerges as opposite of Tartaros;
(4) As Sky and stars emerge, in opposition to Earth, so the internal self-differentiation of Earth into hills-and-dales appears, and then Sea, then, with the active intrusion of Eros, Earth lies with Sky to produce deep-swirling Ocean that runs around Earth;
(5) Finally, the highest reach of heaven is set symmetrically far from Earth, as is the deepest depth of Tartaros—9 + 1 "anvil days"[45]—and a wall of bronze is driven round Tartaros, with its double gates, and night drifts about its throat in a triple circlet while above there grow and branch the roots of Earth.[46]

A conjectural point of interpretation. Tartaros is pictured as a jar,[47] since the ancestors of Hesiod and the archaic Greeks used to bury in the earthen floor of their storerooms the fruits of the earth as well as the corpses of the household's dead. "The subterranean world that the jar symbolizes," according to Vernant, "is the world from which plants grow, where seeds germinate, and where the dead dwell."[48] Accordingly, the roots of the earth are pictured to grow *up from* the jar, just as germinating seeds would sprout from within and appear atop those jars.[49]

## Anaximander's World Picture: The Plan or Aerial View

Hesiod's world pictures offer detail and context found nowhere explicitly in Homer. While both Homer and Hesiod suggest a cosmos dominated by symmetry, where the highest heights and lowest depths are equidistant from our abode here on the earth, Hesiod not only provides assigned measures for these distances

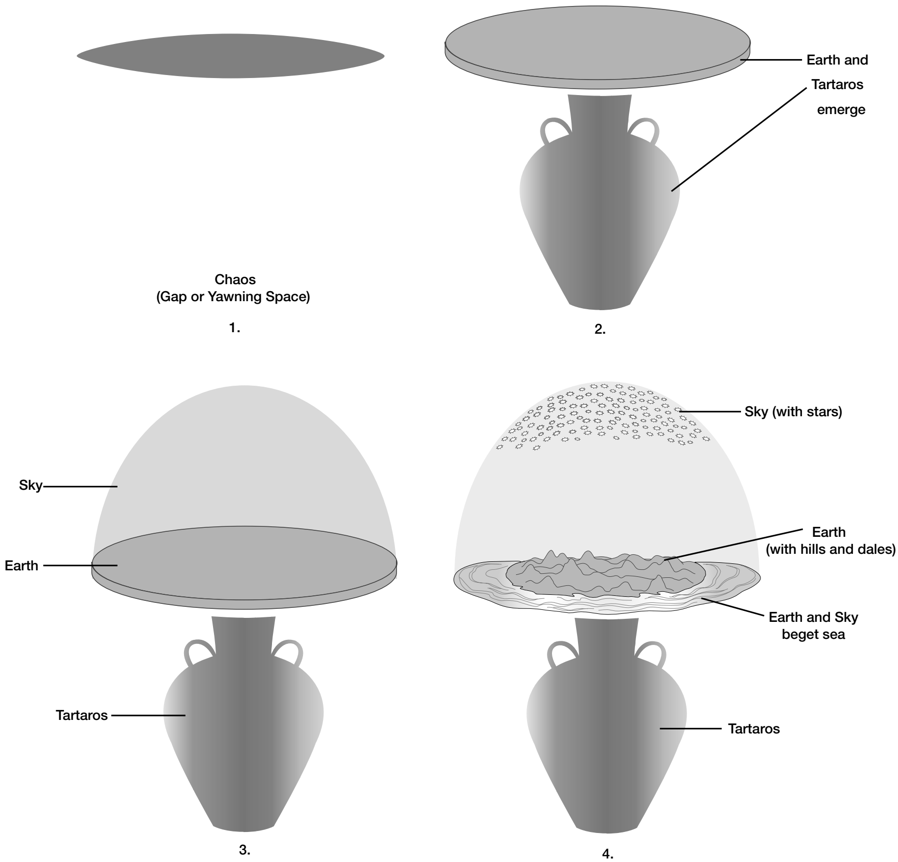
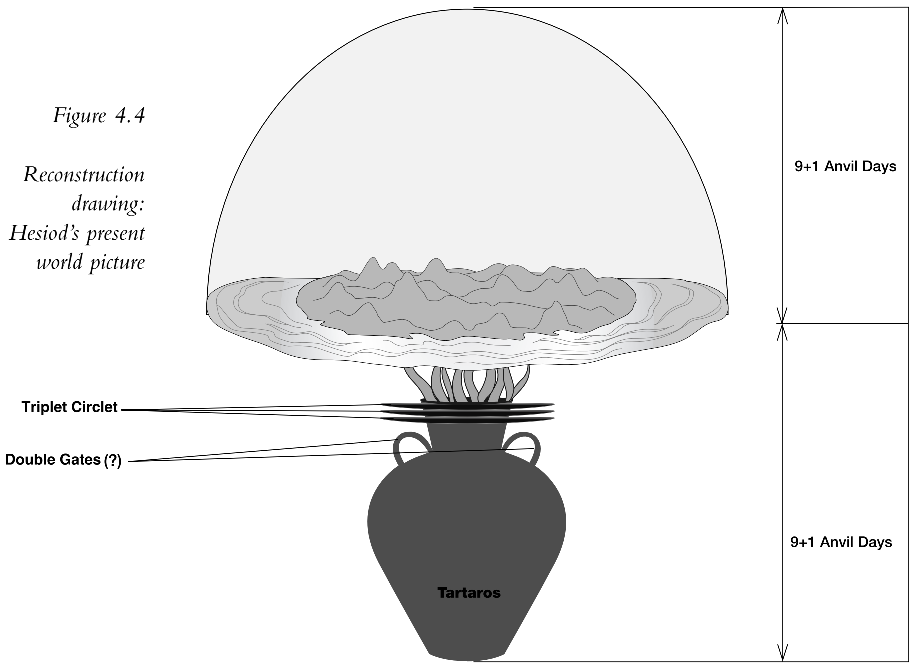



*Figure 4.3*

*Reconstruction drawing: Hesiod's cosmology: Stages preceding present world picture*

*Figure 4.4*

*Reconstruction drawing: Hesiod's present world picture*




**5. Height of heaven and depth of Tartaros established symmetrically from earth (9+1 anvil days). Tartaros is imagined as a burial amphora. The remains of the deceased are placed subterraneously along with fruits and seeds which germinate, sprouting through the top (hence the "roots"). The handles are interpreted as the doors and the triple circlet surrounds the neck of the amphora.**

but also details stages of differentiation prompted by contrariety in which opposites arise from each other, coming-to-be initially in the separation of Earth and Tartaros, made possible by Chaos first of all. When we enter the world of Anaximander we find emphasis on cosmic separation through contrariety and a resulting symmetry, but we are also provided with an extraordinary range of new questions and their proposed answers, which distinguish Anaximander's cosmic preoccupations from those of Hesiod's *Theogony*: while all narrations of gods, goddesses, and anthropomorphic cosmogonies are missing, the whole picture proves to be a projection of a geometrically inspired imagination, both with regard to the form and with regard to the proportions of the cosmos. This new geometrical model, built on simple mathematical ratios, is driven by new questions such as: How far away are the farthest reaches of heaven, now identified with the sun? How big is the sun? How far from Earth is the moon? How far away to the stars? How large is the earth? What is precisely its shape and dimensions? Why does the sun get higher in the sky as summer approaches? Why does the sun get lower in the sky when winter approaches?[50] If the earth does not float on water, why does it not fall?

By virtue of the surviving evidence that we do possess, these questions are strikingly new. They are questions that cannot be even provisionally answered without the application of a language that exhibits mathematical ratios or geometrical propensities. And the case to be made specifically is that Anaximander's cosmic picture was driven from more than one point of view, and his inspiration to do so came from the architects. We first turn to consider the plan or aerial view of Anaximander's cosmos, and then in the next section consider three-dimensional views, with two very different results. Anaximander's cosmology, first of all, draws on a strategy shared with Hesiod's cosmogony, and that account of origins is applicable to both views but is especially telling when seen in plan.

First, let us consider Anaximander's cosmogony, but while we do, let us keep in mind that he is offering a kind of history of cosmic architecture, the stages by which the cosmos was constructed, that is, by which it took geometrical shape, and in this sense allows us to see him as a kind of architectural historian.

(1) In the beginning, there was a homogeneous and undifferentiated unity, the *apeiron*, the undifferentiated stuff out of which everything else is ultimately made.[51]

(2) Second, along with this eternal *apeiron* there is a principle of motion which is also eternal.[52] Just as opposites emerged in their unique identities through separation for Hesiod, so also fundamental oppositions[53]—hot and cold, moist and dry—came-to-be when they were separated out[54] or separated off[55] from the *apeiron*. These oppositions are in fundamental conflict and through their contrariety the cosmos came-to-be. The world picture we now know was not the one in the earliest stages.[56]

(3) Third, according to Anaximander, from the conflicting oppositions the universe took shape first in the form of a sphere of flame[57] that encircled the outermost reaches, like bark around a tree.[58] With the cold and moisture at the center, and hot and dry fire at the extremes, progressive stages of evaporation or drying up continued producing greater differentiation.[59]

(4) Fourth, when that surrounding flame somehow became shut off certain circles were formed constituting the sun, moon, and stars.[60] Each of these fiery circles is like the wheel of a chariot with its felloe hollow,[61] and each is encased in mist. What we come to identify as the sun, moon, and stars are nothing other than apertures in the mist surrounding these fiery wheels that show the fire as though through the nozzle of a blacksmith's bellows.[62] The size of the sun is equal to the earth.[63]

(5) Finally, the cosmos assumes its present order, expressible in simple mathematical ratios and definite geometrical proportions.

The most important element in his cosmic reckoning is the size and shape of the earth, for it is the key to determining the sizes and distances of the celestial bodies. Indeed, this is the fundamental ingredient in the architectural technique of the rule of proportions. First, the dimensions of a central element are defined and then the rest of the construction proceeds in proportion to that element. Unlike Hesiod who reckoned cosmic distances in terms of the falling anvil, and supplied neither the measure for the size of the earth nor any central element by virtue of which all other sizes and distances could be calculated, Anaximander's technique reckoned distances by applying architectural technology.

Anaximander's importation of architectural technology comes in a form that we might regard as the cosmic *syngraphē*. Just as the architects are supposed to have offered a *syngraphē*, a description in words and numbers of the divine house, so, analogously, Anaximander offered a description in words and numbers of the house that is the cosmos. The shape of the earth is described as a column-drum;[64] its cylindrical form is three units in diameter by one unit in depth,[65] a ratio that "is analogous to the distances of the heavenly bodies."[66] Although this interpretation has not gone uncontested, it is held by the vast majority of commentators.[67] The circle of the sun is twenty-seven times the size of the earth,[68] that is, the *distance* to the sun is twenty-seven earth diameters.[69] The wheel of the moon is *distant* from the earth by eighteen earth diameters.[70] The wheel of the stars, remarkably, is nearer than either the sun or moon, presumably nine earth diameters from us.[71] The number series 9, 18, 27[72] means, first of all, far, farther, and farthest[73] but there are several theories that seek to explain the choice.[74]

Diels offered the thesis, ultimately traceable to Tannery and embraced by the vast majority of scholars, that Anaximander's selection of figures to represent astronomical distances was not derived from calculation but rather from poetic and mythical inspiration, and that the number three was central to the series.[75] Gigon also supposed poetic inspiration and wondered if the multiples of nine were not ultimately indebted to Hesiod, and this sentiment was recently echoed again by Couprie.[76] Kahn held that not poetic but rather mathematical inspiration explained Anaximander's numbers, for they illustrated his belief that the cosmos was governed by simple mathematical ratios. And most recently, Naddaf has argued that a trifold political inspiration motivated Anaximander's selection of numbers.[77]

Some years ago, Eggermont joined in this debate by venturing a theory in which the number twenty-seven was the key to Anaximander's selection of numbers.[78] He, too, noted that not by appeal to astronomical measurements but by some other culturally embedded concerns did Anaximander arrive at these specific assignments. The intriguing thesis Eggermont offered was that the sun was identified with gold and the moon with silver, the determination of the sun's distance was fixed at twenty-seven by appeal to the new monetary standards introduced by Anaximander's contemporary, King Kroisos, patron of both the great temples of Artemis at Ephesus and Apollo at Didyma, who fixed the ratio of gold : silver at 13.5 : 1. The value of gold, in Eggermont's estimation, took on astronomical proportions. The Babylonians, some of whose astronomical knowledge was likely known to Thales and Anaximander, held that there were 360 days in a year[79] and twenty-seven days in a month of a sidereal year, and Eggermont wonders if these ratios, both illustrative of standards cosmically imposed and humanly interpreted, did not play a pivotal role in Anaximander's selection. Thus, Eggermont thinks that the assignment of twenty-seven to the ring of the sun is a sort of cryptogram that compares the sun with the gold of Kroisos, for the gold-sun, 360, divided by the value of gold (13.5 : 1) equals twenty-seven.

Eggermont's thesis is interesting, even if ultimately uncompelling, because he forces us to consider other efforts to establish standards, in this case the intrinsic value of metals and hence of coinage as such, for this search for standards is characteristic of the origins of Greek philosophy. The origins and proliferation of the new invention of coinage is roughly contemporaneous with Anaximander and we can only imagine the significant ways in which coinage was revolutionizing commerce and consequently social relations. But his thesis has an abundance of problems as it is presently stated that undermine whatever intriguing force it might have. First of all, the ratio is "gold : silver" and hence "sun : moon" and not "sun : earth" as is required by the formula 27 : 1. Secondly, the numerical assignment of eighteen to the moon wheel is based upon another far-fetched guess of the value of the silver hemi-stater and bears, as Eggermont himself admits, "no relation whatever with mathematics and even less with astronomy."[80]

Naddaf also joined the debate recently, focusing his attention, like the vast majority of scholars, on the number three, but this time, following a clue from Gomperz,[81] emphasized political inspirations for Anaximander's selections. Naddaf champions the thesis developed along these sociopolitical lines by Vernant[82] that Anaximander's numerical assignments sought to draw a parallel, as in myth, between the cosmological model and the sociopolitical model, thus again confounding nature and society. In both cases, according to Naddaf, *isonomia* is the predominant theme. But Naddaf takes these earlier thoughtful leads to a new and brilliantly original proposal, namely, that Anaximander's cosmology should be viewed in light of his *utopian* disposition. For Anaximander, the new emphasis is now placed, not on whether the terrestrial state reflects the celestial state but rather on the notion that it ought to. Although his arguments follow Vernant's in tracing the development of the polis and the creation of an agora around which the three classes he identifies—aristocrats, newly emerging middle class, poor—sought their appropriate place within the city, Naddaf's strategic argument does not succumb to the criticisms that might follow, for example, should we accept the findings by Hoepfner and Schwandner that cast doubt on whether Miletus had an agora in the first half of the sixth century BCE.[83] For, on Naddaf's thesis, Anaximander's utopian motivations need only address the question of cosmic structure insofar as it promotes the way things should be in the just city whether or not they so happen to be that way. Thus, the three rings and their relations to the center (earth), according to Naddaf's utopian interpretation of Anaximander, is analogous to the three classes and their relation to the center (agora). Although the series 9, 18, 27, which reflects the sizes of the three celestial rings, is based on the dimensions of the earth, these in turn, were politically, not astronomically or observationally, motivated. The force of Naddaf's brilliant thesis is that it requires an understanding of the powerful role that a political model imposes on the manner in which the celestial map became meaningful for Anaximander. Just as Vlastos had argued earlier[84] that Hesiod's symmetrical cosmos was driven by a political inspiration, so also Naddaf comes from a similar school of thought. But Naddaf's argument encounters formidable difficulties, not least of which is the absence of any report in the doxography attesting to such a view. The three celestial rings are supposed to correspond somehow to the three classes in Anaximander's utopian vision. But Naddaf does not tell us how. To think that the aristocrats would be nearest the center is initially plausible, but then they correspond to the ring of the stars, that is, the *least* bright ring. The poor would seem most plausibly to be relegated to the most distant place from the center in the well-formed polis, but then they correspond to the *brightest* ring, the sun. The strength of Naddaf's argument rests ultimately on its ability to illuminate how the three rings promote a utopian model. But, so far, the specific details of this proposed trifold distribution have not been supplied.

Those who have championed the view that the selection of three was pivotal to Anaximander's number series 9, 18, 27 seem to be most certainly right.[85] Long ago, Kirk-Raven grasped well that the size of the cylindrical earth, 3 × 1, was a size that is analogous to the distances of the heavenly wheels.[86] The identification of the dimensions of the earth, therefore, was fundamental to the other assignments. Then, Anaximander's series of distances to the stars, moon, and sun as nine, eighteen, and twenty-seven earth diameters would convey to an archaic audience "extraordinarily far (='9'), farther still (9 +*9*), and farthest (9 +*9*+*9*)"[87] while still maintaining a view that the universe is constructed on simple mathematical ratios, as Kahn declared.

The next step in the exegesis of Anaximander's technique is to trace the process, on analogy with the architects, from the cosmic *syngraphē* in words to the drawing marked by numbers and measures. According to the surviving testimony, we have evidence for the number twenty-seven[88] and twenty-eight[89] connected with the sun ring, and the number nineteen[90] connected with the moon ring. The scholarly literature has argued about this testimony and what to make of it.[91] On the one hand, the debate has been about whether Anaximander's numbers express the sizes of the rings or their distances from earth. On the other hand, the debate has been to determine which number series to accept. Again, I follow Couprie here.[92] Anaximander, unlike any predecessor of whom we know, offered the remarkable view that there is depth in heavenly space, that the stars, moon, and earth are not at the same distance removed from us but rather lie behind one another and at very great distances of separation. Couprie refers to this as Anaximander's *discovery of space*. If we reflect upon the originality of this conception, we can see more clearly that Anaximander was preoccupied with the varying distances to the celestial wheels, not their sizes. Now, while most commentators accept twenty-seven for the sun ring, the numbers eighteen and nine, for which there is no testimony, are offered as conjectures to create a number series that displays a simple mathematical ratio as multiples of three. This has been the approach adopted since the time of Tannery;[93] the missing number eighteen has been supplied to Hippolytus's testimony, and then nine has been conjectured for the closer star ring: 9, 18, 27.

The chorus of those who have supported the numbers nineteen and twenty-eight have accepted some form of the argument that the nineteen and twenty-eight denote the outermost part of the moon ring and sun ring, and hence the number ten is added to the conjecture of nine to complete the series.[94] However, these authors maintain that diameters, not radii, were meant by the numbers. This would mean that the thickness (or breadth, or felloe, as Kirk says) of the ring would be only one earth diameter, so that the outer rings equal $9 + (2 \times 1/2) = 10$, $18 + (2 \times 1/2) = 19$, $27 + (2 \times 1/2) = 28$ earth diameters. And so it is in Diels's original picture. According to Kirk, however, this doesn't seem to be in accordance with the idea that the felloe must be one earth diameter thick. His solution is to make the numbers 10, 19, 28 represent the diameters from outer edge to outer edge, and the numbers 9, 18, 27 the diameters "from points half-way between the outer and inner edges of the actual felloe of air."[95] Others, such as Rescher and Couprie, argue that if radii and not diameters were meant, the figures given would hold.[96] Couprie, however, has changed his mind on this position. He rightly argues that Anaximander was preoccupied with the varying distances to the celestial wheels, and thus with the radii of the rings. Thus, while the distance to the innermost part of the star ring is nine earth diameters, the outermost part of the ring marks the tenth; while the distance to the innermost part of the moon ring is eighteen earth diameters, the outermost part of the ring marks the nineteenth; and while the distance to the innermost part of the sun ring is twenty-seven earth diameters, the outermost part of the ring is marked by the twenty-eighth.[97] This solution is fully in line with what an archaic audience could understand, as Hesiod showed—nine days would the anvil fall arriving on earth on the tenth: 9 + 1. Hesiod's formula reflects the archaic shorthand that nine represents extraordinary distance (or duration) and hence 9 + 1 is the ultimate topper. Indeed, 9 + 1 is the formula for expressing the distance of the uppermost reaches of the heavens from the earth. Anaximander calls on just this formula to express heavenly distances but goes further by insisting that there is depth in space and 9 + 1—the ultimate topper—proves instead to be merely the profound distance to the closest heaven, that is, stars. For in Anaximander, the distance to the star ring is so great that it is 9 +1 earth diameters away. The moon ring is twice as far—9 + 9+1, and the sun ring is thrice as far as Hesiod could conjure for the whole distance from Earth to the heavenly limits—for the archaic audience a mind-boggling 9 + 9 + 9+1 earth diameters away. Seen in this fashion, we can make sense of both series: while 9, 18, 27 preserves the geometrical uniformity and simple mathematical ratio in terms of multiples of three, the number series 10, 19, 28 preserves the archaic/Hesiodic formula of 9 + 1, now imported in terms of Anaximander's original insights that (1) there is depth in the universe, and that (2) vast distances can nevertheless be formulated proportionately.

But to this view, the new substantiating argument is made by appeal to architectural techniques. Each wheel is exactly one diameter thick because, following the rules of proportion technique, the central *module*—column-drum earth—is one unit; and the numbers 27/28 (plus 19), which have been preserved for the sun wheel, make this picture quite clear. Thus, let us presume that just as the architects wrote out the *syngraphē,* and then made informal drawings, and then perhaps a model roughly to scale to show the archaic patrons and builders, so did Anaximander. He wrote out the cosmic *syngraphē*, and then made his illustrative drawings, and perhaps a model roughly to scale to show his archaic audience. The architects wrote their *syngraphē* after hearing the wishes of the archaic patrons, then made informal drawings with the numbers and measures that were expressions of those specifications, and which they marked out and indicated by scratch lines on the stylobate constituting the exact ground plan. If the analogy holds, we could expect that Anaximander wrote the cosmic *syngraphē* and then by means of a compass made an informal drawing—a cosmic ground plan, here a horizontal cross-section—marking out exactly the cosmic construction: first, the central architectural module, the column-drum earth, as seen from the aerial perspective, round like the drum circumference, and then, with the compass, nine earth-diameters could be measured to the inside edge of the star wheel, then one column-drum unit for the width of the wheel making the outside marking at ten units, just as the architects might have measured the stylobate and made scratch marks for installing each drum base; so also for eighteen earth diameters to the moon wheel and then marking the outside of that wheel as nineteen, then finally measured twenty-seven earth diameters and, with the one additional column-drum earth to mark the width of the sun wheel, identified the outside of that ring with the number twenty-eight. In this way we can see how the surviving evidence can be used to support the claim that Anaximander imported architectural techniques into his philosophical and cosmological thought.

Furthermore, there are other considerations that strengthen this case for architectural influence. The distances of the stars, moon, and sun from the earth are in a ratio of 1 : 2 : 3, precisely the same kind of simple ratios that characterize the overall structure of the archaic temple. Seen in this light, Anaximander imagined the cosmos to be a kind of temple, the cosmic house, along the analogy of the cosmic meaning of the column. The column-drums at the archaic Heraion, Artemision, and Didymaion were roughly 3 × 1, and symbolically they had a cosmic significance in the context of the whole column for both connecting and separating the earth from the heavens.[98] The column separated the heavens from the earth, according to Homer[99] and Hesiod;[100] joined them, as Pindar declared,[101] or, as Plato related in the Pythagorean cosmic and transmigratory Myth of Er, served as a central axis that ran through both of them.[102] Anaximander's image of the heavenly rings as hollow wheels of a chariot envisages the *locus classicus* of a cosmic axle around which the heavenly wheels turn. To the archaic Greeks, then, the column had a cosmic and religious, as well as a structural significance, and when the point is made that architectural inspiration plays a contributing role to Anaximander's cosmic imagination, we must understand that temple architecture from which the new invention of the column-drum emerges is an intersection of religious, political, and social interests that brought together expertise in applied geometry. When Anaximander declares the column-drum earth to be 3 × 1 it is as if we are overhearing the Ionic community's discussion—architect, aristocratic patrons, priests, and community members—about the symbolic meaning of temple parts.[103] The sociopolitical context will be taken up in the next chapter. For now, emphasis needs to be placed on the technology of archaic stone columns. Anaximander's column-drum Earth, and the heavenly bodies in proportionate distances to it, echoes the cosmic significance of the architects' sacred temple, the cosmic house as opposed to Anaximander's imagination of the columnar house that is the cosmos.

Picturing Anaximander's universe evokes a variety of images. Scholars have broadly accepted this narrative of his cosmogonical stages and resulting cosmos that we have described here. What follows is an attempt to render it pictorially. Just as we provided for Hesiod, emphasis is placed on the cosmogonical feature of Anaximander's universe. The present state of the cosmos is *not* as it had been. An understanding of the present condition requires an understanding of preliminary states without which our current universe would be incomprehensible.

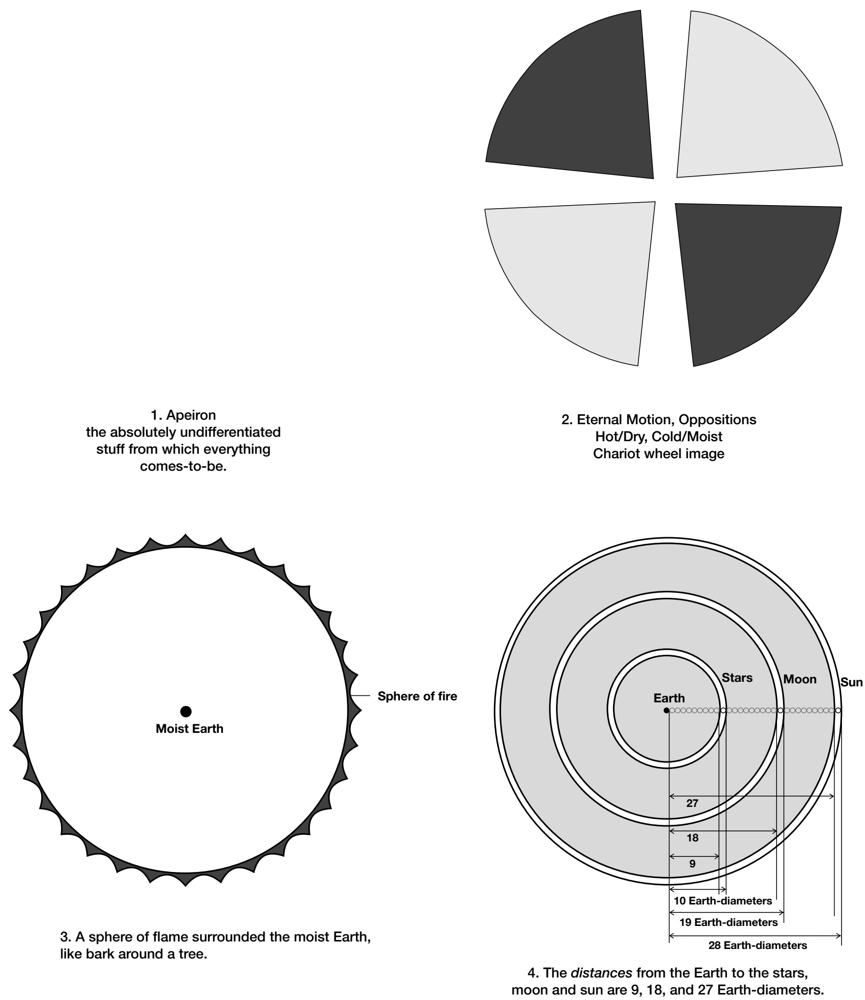



*Figure 4.5*

*Reconstruction drawing: Anaximander's cosmological stages leading to the present world picture*

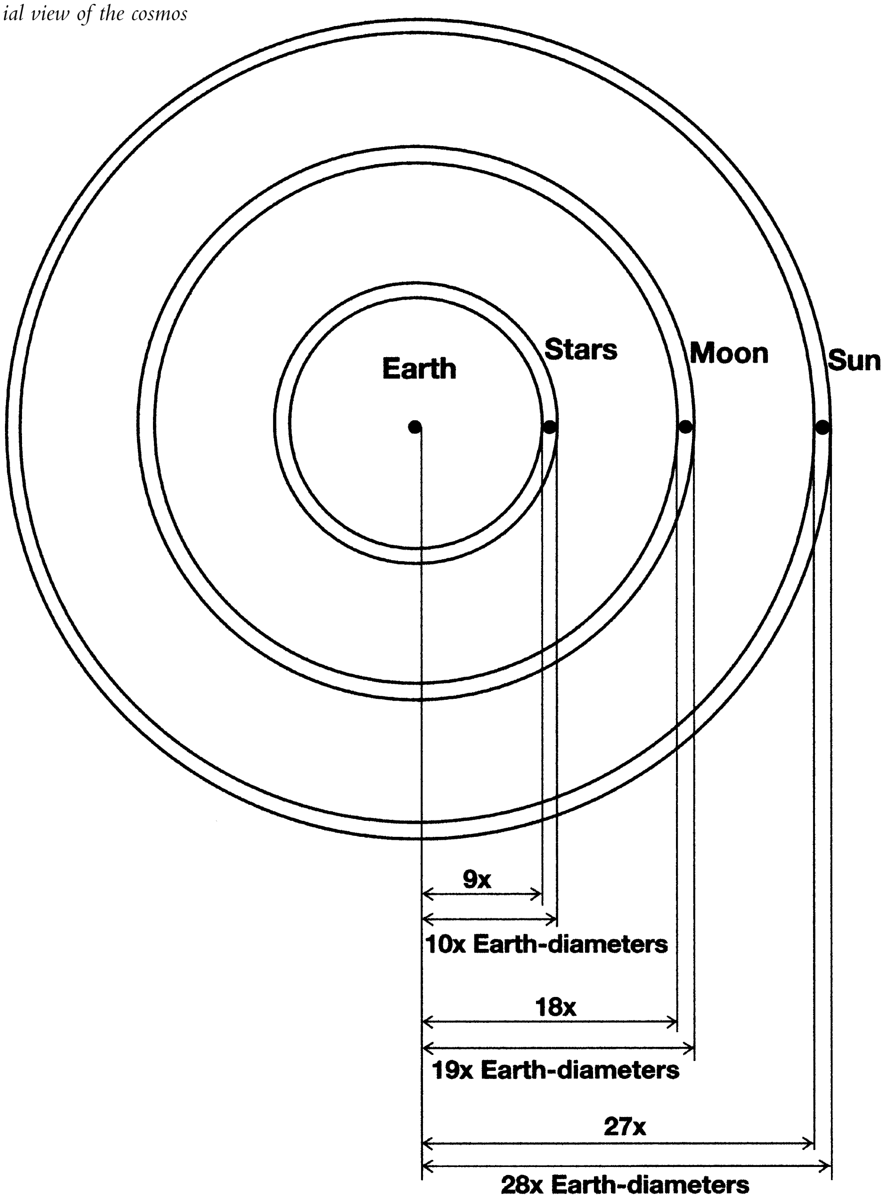
The extraordinary monumentality of the archaic temples in Didyma, Samos, and Ephesus, is achieved by the columns that, for all three temples, were at least fifty feet in height. The difficulty of quarrying, moving, and erecting monolithic columns posed formidable problems the solution for which was the new technical idea of constructing the columns of drums. This greatly relieved problems in quarrying and transporting the stone. But with this solution came a new problem, namely, how to assure that each drum would fit perfectly atop the one below it so as to be evenly balanced and successfully carry the architraves and the rest of the entablature above. As we have already considered, to solve this challenge, the architects made use of a technique—*anathyrōsis*—new to Ionia for constructing the columns out of drums.[104] Let us first remind ourselves of Anaximander's column-drum earth and his cosmos constructed in earthly, that is, column-drum proportions. The plan view—that is, a horizontal cross-section through the plane of the earth—displays the uniform and symmetrical relation in which the earth stands to these heavenly wheels. These wheels, in the plan perspective, appear as concentric circles set around the round earth (figure 4.6).

Among all the commentators who have published drawings of Anaximander's cosmos, apparently no one has ever explicitly raised the question, "From what perspective?" The study of the techniques of the ancient architects has provided the motivation for this question to be raised for Anaximander. In the history of commentators who have attempted to make drawings, the earliest example of a plan view, that is, a horizontal cross-section, analogous to the architect's plan view, is traceable to Diels.[105] His diagram is presented in figure 4.7.

Rescher, in setting out drawings illustrating the stages of cosmic development, follows in the tradition of Diels but neither seems to be aware of the significance of setting out such views alongside other drawings that exhibit oblique, three-dimensional, or axonometric views.[106] An important difference in interpretation is that Rescher takes the numbers to refer to distances while Diels makes them refer to the sizes of the rings. Rescher's rendition captures a form that is both significant and

*Figure 4.6*

*Reconstruction drawing: Anaximander's plan or aerial view of the cosmos*



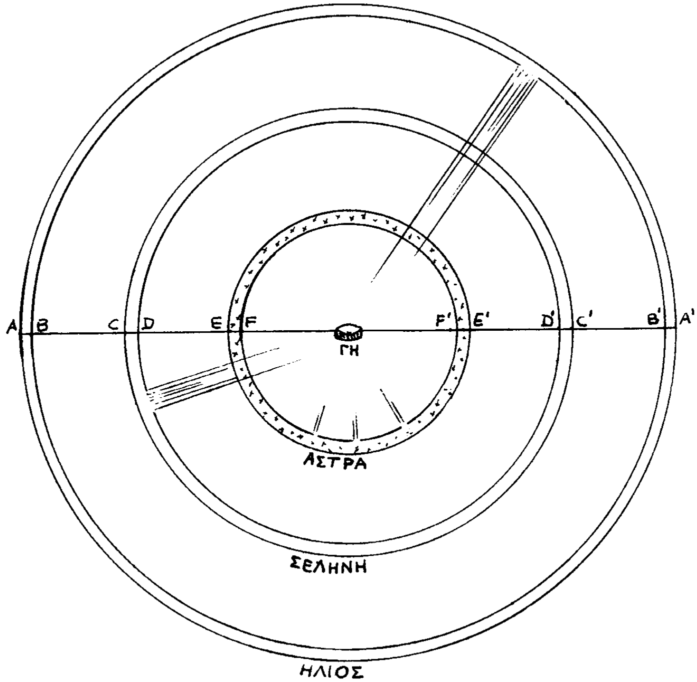



*Figure 4.7*

*Reconstruction drawing of Anaximander's cosmos, after Diels*

revelatory. But the shortcoming of his approach is that he gives fiery form to the formless *apeiron*, which he places at the extremes,[107] and he, like Diels, neither grasps the architectural importance of his illustration nor does his essay seem conscious of the import of questioning "from which perspective?" Rescher's insightful rendition appears opposite.

That Anaximander might likely have thought of his universe in plan finds additional encouragement from two sources. The first, which we shall take up in detail in the next section, is the testimony of Agathemerus and Strabo that Anaximander was first to make a map of the inhabited earth; the drawing on a tablet *must* be a plan view.[108] Second, Anaximander's cosmogonic imagery, on the authority of Pseudo-Plutarch, lends itself peculiarly to a plan view:[109] The formation of the cosmos is the formation of the cosmic tree. A ring of fire enclosed the air like bark (*phloios*) around a tree (*dendron*), and when it somehow

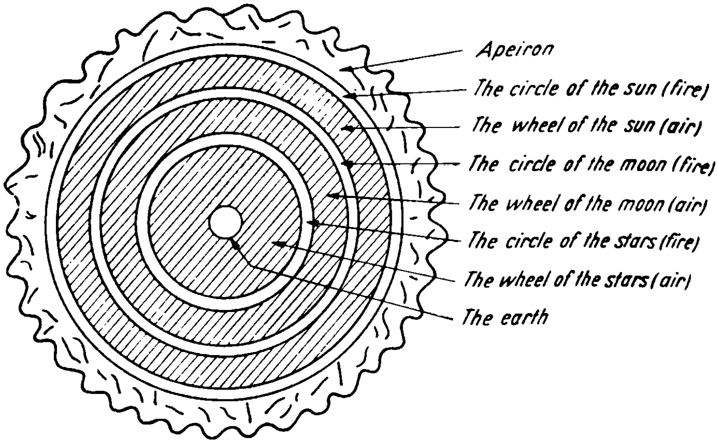



*Figure 4.8*

*Reconstruction drawing of Anaximander's cosmos, after Rescher*

became broken off, the circles of the sun, moon, and stars were formed; the image suggested is a horizontal cross-section of a tree. Below is an attempt to render the formation of the cosmos from the ring of fire, in plan view (right). Next to it is a cross-section, plan view, of the concentric rings in a tree that serves as the metaphor, or conceptual analogy, for illuminating his idea.

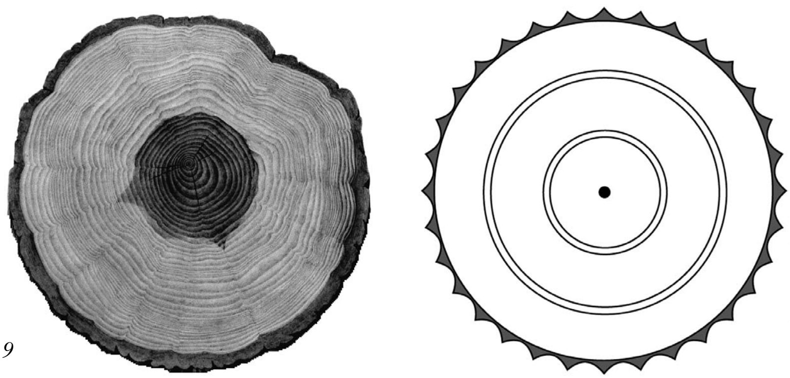


*Figure 4.9*

*Rings in a tree and Anaximander's plan view*

The discussion has taken this course by simply thinking through Anaximander's preoccupation with the column-drum. There is too much here to pass off as mere coincidence. The columns in the earliest temples were trees. They were replaced in sixth-century Ionia by turning out stone drums, a marvelous new innovation. Like the column-drum, Anaximander's earth is situated *en meso*; the earth-drum is set in the middle by a very definite calculation guided by geometrical techniques and simple mathematical ratios.

If one reflects on the possible plan view of Anaximander's world picture and finds some reassurance of the usefulness of that image to his thought by considering the plan view of a tree to which he evidently refers, we have now to confront perhaps the most compelling evidence of the role that temple construction, and hence the architects, likely contributed: the *anathyrōsis* technique. Given the hint by the *testimonia* that Anaximander identified the shape of the earth with a column-drum it is somewhat remarkable that in none of the scholarly literature is an archaic drum displayed in order to consider the possibility of new or additional insight into the image that Anaximander might have had in mind when he found the image so telling. Opposite is a display of the *anathyrōsis* technique as it is applied to the preparation of column-drums and bases. In this example, following Orlandos, what we have can be regarded as a *paradeigma* or specimen of the finished product to be produced. The striking image, just the kind we suppose to have been visible at the building sites for the craftsmen to refer to as their work proceeded, immediately conjures Anaximander's vision of a ring of fire with concentric bands as in the concentric circles in a tree, viewed in plan.[110]

As we have already considered, the solution to the problem introduced by the increasingly massive stones required for monumental temple building was to dress the vertical sides with a band around all the edges, not just the top and side, and this technique came to be known as *band anathyrōsis*. When applied to column-drum construction, the *band anathyrōsis* technique was applied to the horizontal face of both intersecting drums so

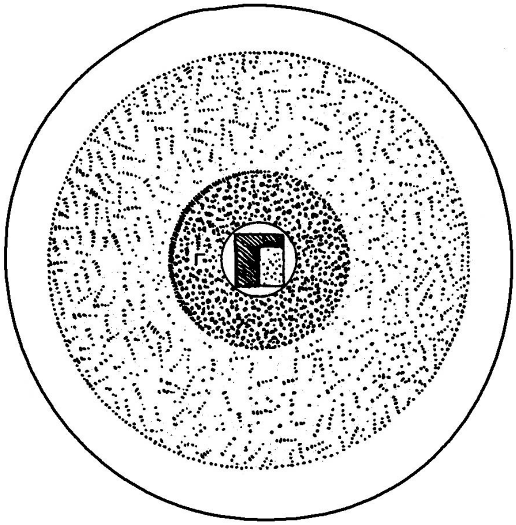


*Figure 4.10*

Anathyrōsis *technique displayed on a column-drum, after Orlandos*

that one drum could interface perfectly with the drum already set (or the base, if it is, so to speak, the first drum).[111] In order to achieve a stable result, the Ionian architects discovered that the whole surface of the drum does not have to be carved smooth. If it were necessary, there can be no doubt that it would have been done. This preparation requires that only the outside lip, a ring or wheel concentric to the drum's circumference, a shape that Hippolytus calls *strongulon*, "round,"[112] be carved smooth. This was affected by the architect's technique of using a caliper, a kind of compass, and marking off a band around the drum's circumference, having measured the inside and outside edge of the band just as Anaximander might have measured out the inside and outside edge of the band representing the heavenly wheels. In the architectural technique, the portion of the drum inside of this carved circumference ring is chiselled, making the surface concave. This way when the two drums are placed together the full fit is placed on the carved lip and no interior part of the surface may extrude and thereby place the stability in doubt. For this reason, the manuscript reading of ὑγρόν must be mistaken, as both Diels and Kirk-Raven suggested, but neither offered an appeal to *anathyrōsis* to defend his position.[113] The testimony by Hippolytus, τὸ δὲ σχῆμα αὐτῆς (sc. τῆς γῆς)) γυρόν, στρογγύλον, κίονος λίθῳ παραπλήσιον ("the form of the earth is *curved*, round like a column-drum"), has troubled some commentators who wondered if στρογγύλον ("round") was simply a gloss of γυρόν ("curved"). But, seen from the point of view of column-drum preparation, both words emphasize different aspects of the shape of the earth. On the one hand, the circumference is round, and on the other, the surface is also concave; in both cases, just like a column-drum. At the same time, the drum *anathyrōsis* perfectly preserves the image of Ocean running round the circumference, presented long before by Homer, and embraced also by Hesiod.

When the outside lip of the drum is carved smooth and the interior surface is chiselled out, making it concave, additional concentric lines regularly appear on the drum faces creating the appearance of tree rings in the stone that replaced the familiar trees. The resulting appearance bears a striking resemblance to Anaximander's geometric cosmos imagined in plan, and these drums certainly preceded his mention of them in his prose treatise. The purpose of the concentric rings on the drum is to divide the surface into geometrically precise regions that serve as guides for the masons' efforts. This is crucial because the architect must determine the precise center of the drum in order to ensure that the circumference of each drum is equidistant from the exact center and so will fit exactly the other drums. To be certain of the exact center, one or two concentric lines are measured onto the drum face, in addition to the carved circumference that often appears as the third concentric ring. To achieve this result, in the precise center of each drum a hole is made for the device called the *empolion*, which we have also already discussed.[114]

This architectural technique of *anathyrōsis* and *empolion* was an innovation and one of many *thaumata* that astonished Anaximander and his fellow Ionians. The architects provided a community with activities and marvelous innovations in response to a host of technical problems that called out for clever solutions.

In the image of column-drum *anathyrōsis*, a technique employed to keep the drum motionless in its place, Anaximander found a complexly suitable image for his Earth that also remained motionless in the middle. The argument here is not that the architects' specific measurements on the drum face were adopted by Anaximander, but rather that the stone column, like the sacred tree, already had a cosmic meaning for the archaic community, and the *anathyrōsis* preparation on the drum face suggested unmistakably the image he embraced and in terms of which the whole cosmos was to be imagined. Furthermore, in the image of the drums, roughly 3 × 1, visible to all the inhabitants in his Ionic community, his pronouncements would resonate most clearly, and his prose book, rivalling the architects' for excellence and insight, would have a ready audience with those who were already filled with wonder by the monumental constructions.

Just as architectural techniques offered solutions to assure both vertical and lateral fixity of their monumental houses, Anaximander wrestled with challenging questions concerning the accounting for the vertical and lateral fixity of the heavy earth in the house that is the cosmos. Why did it not fall downward? Why did it not move sideways? Why does the earth stay fixed in place, securely in the middle? The solutions that the archaic architects offered for their technical problems were twofold. To assure vertical fixity, especially at the Samian Heraion and Ephesian Artemision where the swampy precinct was sacred to the fertility goddesses, the platform and stylobate had to be set so as not to collapse under the added tonnage of colonnades and the enormous weight of the building structures that they in turn had to carry. Pliny's account claims that when Chersiphrons' and Metagenes' first effort at the Artemision ended in failure with the collapse of the foundation, the services of Theodorus were enlisted. Theodorus's solution was claimed to be placing layers of sheepskins and charcoal beneath the foundation to ensure stability in the marshy soil.[115] So much for vertical fixity. The problem of lateral fixity deeply absorbed the architects, as the *anathyrōsis* technique displays. To keep the drums motionless, the outer lip was carved smooth and after careful measurements resulting in inner concentric circles as guidelines, the entire inner surface was countersunk, and a hole was made precisely in the center. The *empolion* would ensure a centered connection between upper and lower drums—the new drum would be placed in the middle—so that it would be least susceptible to move laterally (as well as vertically).

Anaximander's solution to the problem of accounting for the vertical and lateral fixity of the heavy earth has been defended by two different chains of reasons. On the one hand, on the authority of Aristotle in the *de Caelo*, Anaximander was distinct among the early philosophers by holding that the earth remains at rest in the center διὰ τὴν ὁμοιότητα, because it is in equilibrium, equidistant from all extremes with no impulse to move in any direction, and thus remains at rest.[116] On the other hand, on the authority of Simplicius and hinted at in another passage of Aristotle's *de Caelo*,[117] some interpret the reason for the earth's immobility to be the δινή or vortex.[118]

Furley most recently defended a version of the vortex theory.[119] He followed the problem raised by Heidel[120] and then explored in greater depth by Robinson.[121] In the *de Caelo* in one of the very few passages where Anaximander is mentioned by name, Aristotle singles him out as being among the ancients who held that the earth remains at rest because it is in "equilibrium" (ὁμοιότητα).[122] According to Anaximander, the earth, says Aristotle, is at rest in the center and does not move up or down, or to the sides, because it is equally related to the extremes (ὁμοίως πρὸς τὰ ἔσχατα ἔχον), and thereby has no reason to move one way or the other. But, the objection goes, only a *spherical* earth—not a flat and cylindrical earth—is equally related to the extremes. So, Aristotle, according to Furley, has somehow got it wrong. Instead, Furley defends the claim made by Simplicius that Anaximander's Earth remains at rest in the center because it floats on air.[123] And this accords well with Aristotle's assertion just before his pronouncement of the equilibrium thesis in the *de Caelo*, namely, that all the earlier thinkers who held that the cosmos had a beginning adhered to the doctrine of the vortex.[124]

Furley's argument is that this interpretation fits better within the Milesian tradition of Thales and Anaximenes who both hold theories of a floating earth, the former on water, the latter on air. Just as Anaximenes held that the earth floats on air,[125] so Anaximander held, according to Furley, that the earth also floats on air and declared its shape to be a flat disc so that it would remain aloft. On Furley's account, then, Anaximander's Earth floats on air *and* remains in equilibrium or likeness; by this he takes "equilibrium" to mean that "it does not tilt like an unevenly loaded raft."[126] But Furley must reject Aristotle's testimony as confused when he offers the view that the cylindrical earth stays at rest because it is equally related to the extremes.

Furley grasped the problem of interpreting testimony on Anaximander's cosmos to arise from what seemed like two different conceptions of its shape. On the one hand, the heavenly rings suggest unmistakably a circular shape, while on the other, the tree metaphor, entailing the formation of the cosmos by flame[127] surrounding the air like bark around a tree suggests unmistakably a cylindrical shape. Furley's effort to interpret the image of Anaximander's cosmos forced him to reject as incredible Aristotle's assertion that, in effect, Anaximander was the first to hold terrestrial immobility—vertical and lateral fixity—on the grounds of the principle of sufficient reason, so richly celebrated by those such as Kirk-Raven-Schofield,[128] Guthrie,[129] Lloyd,[130] McKirahan,[131] Naddaf,[132] Couprie,[133] and many others.

Aristotle, no doubt, may have gotten it wrong as he has in other cases involving the Presocratics.[134] But suppose he did not. How could we reconcile Aristotle's testimony against the apparently formidable objection that only a spherical earth—not a cylindrical earth—could be *equidistant* from all extremes? The approach proposed here offers a resolution without having to suppose still another possibility, namely, that Aristotle is reporting accurately and it was rather Anaximander's mixed images that were incompatible.

If Anaximander had imagined the cosmos in both plan and three-dimensional views, the way in which the earth and the heavenly rings would be situated would be quite different in each perspective. In each view, like that of the temples, the harmony, order, and pattern would be conceived differently.[135] If one takes for granted that Anaximander's picture is strictly an elevation view, then Furley's objections are hard to discount. But what requires us to suppose that Anaximander's model was exclusively conceived as an orthographic projection other than plan, or three-dimensional view? Had he envisioned the cosmos as he must have imagined the map of the inhabited earth—as a plan view—Aristotle's testimony could be preserved. For then, in plan view (that is, in horizontal cross-section cutting through the plane of the earth) the round earth *is* equally related to the extremes. In the plan view, the earth is in equilibrium in the cosmos; it is equidistant to the heavenly rings that stand in simple mathematical ratios to the column-drum earth. By accepting this proposed multiperspective interpretation of Anaximander's imagination we are able to preserve the testimony of Aristotle and this is not unimportant, for it is difficult to accept that in one of only four times in his entire corpus that Aristotle singles out Anaximander by name he has simply got it wrong.[136]

The thesis under investigation, however, is that Anaximander imagined the cosmos from more than one view: plan and some variations of three-dimensional view. It is also quite possible that Anaximander made a model, but since such a model would incorporate a three-dimensional view we can consider it within the discussion of the orthographic projections other than plan, to include elevation views, side views, obliques, and axonometric projections.[137] To that discussion, we now turn.

## Anaximander's World Picture: Three-Dimensional Views—The Side, Elevation, Oblique, and Axonometric Views

When we try to picture Anaximander's universe in three-dimensional views,[138] different features of his cosmic imagination are highlighted. Scholars who have attempted to make graphic renditions of Anaximander's world picture have tended to represent it either in elevation or oblique aerial view.[139] Why this is so merits reflection. First of all, the aerial perspective, or plan view, is, perhaps, not our common perception. When we try to imagine a building, or sculpture, perhaps the elevation or oblique aerial view comes more readily to mind. Although the sequence of his inquiries must remain a conjecture in the absence of definitive evidence, it seems likely that Anaximander, first of all, was concerned with the earthly map, the *oikumenē*, the model of the inhabited earth, for which the seasonal sundial he invented or introduced was indispensable. The terrestrial mark-points corresponding to the rising and setting of the sun on the solstices and equinoxes[140] were the keys to measure the frame of the earth, and so provide boundaries for constructing the earthly map. Only subsequently did Anaximander turn to the heavens to produce a map and/or model of the whole cosmos, in plan like the earthly map, and then in three dimensions as was required by his very idea of tracing the changing but regular elevations of the sun through the use of his seasonal sundial. Seen in this light, his seasonal sundial, while allowing him to construct terrestrial cartography, was the connecting link to his subsequent efforts at cosmic cartography.

"With the Ionians and those who followed them the celestial phenomena, though exciting great interest, were secondary to the earth in importance."[141] Heidel's appraisal more than a half-century ago emphasized a fact that aptly describes the disposition of ancient peoples of whom we know prior to the sixth century BCE. Celestial astronomy seems to have served two principal needs:[142] on the one hand, an awareness of repeating patterns of celestial motions was essential to determining a calendar that would instruct the proper times to plant the annual crops so crucial to the survival of cities, and on the other, that same astronomically derived calendar would be central to determining when the king and his priestly assistants should perform the rites necessary to propitiate the divine forces. The surviving evidence of ancient peoples consistently points to an interest in celestial motions as a means to terrestrial ends. Perhaps Anaximander's enterprises should be seen as a transitional point in which, increasingly, individuals sought a knowledge of the heavens for its own sake, independent of its earthly usefulness. But, as a transitional figure, he still belongs to a world in which earthly concerns were the first order. And since the changing elevations of the sun were key to bounding his earthly map,[143] we turn first to it prior to an investigation of his cosmic drawing/model, rendered vertically and obliquely.

The ancient evidence suggests unmistakably that Anaximander was the first Greek to make a map of the inhabited earth. Although his map does not survive, we do have a neo-Babylonian map, roughly contemporaneous with his and that of his illustrious successor, Hecateus.[144] The map, inscribed on a tablet, displays the "Bitter River" (what the Greeks called "Ocean") running round the circumference and the Euphrates leading down the oblong plan to Babylon. At the center there is a hole, perhaps produced by a compass, and it echoes for us Herodotus's observation that the early maps of which he knew appeared to be *apo tornou*, "drawn with a compass," or even "turned on a lathe."[145] The triangles projecting out from the River/Ocean circumference are untypical of the Greek maps; according to the cuneiform text surrounding them they demarcate outlying districts containing fantastic creatures. The neo-Babylonian map of the "new empire" appears opposite, and from it we have a historical index against which we can better gauge our reconstructive efforts.

In order to understand Anaximander's innovation there are two general issues to be addressed: (1) *Why* make an earthly map? and (2) *How* did Anaximander do it? The "why" issue seems straightforward. The Milesians Thales and Anaximander were practical geniuses with broad interests in projects that involved applied geometry. Thales, as we have already noted, was credited with inventing new techniques both for celestial navigation and for determining distances, whether to the top of a pyramid or to a ship at sea; Anaximander is credited with founding a new colony, perhaps on the Black Sea. A knowledge of earthly measurements and distances would prove useful to those Ionians involved in commerce, trade, and colonization. The earthly map of Anaximander, then, likely emerged from practical challenges. Did Anaximander know of the neo-Babylonian map, which might have been either a source or guide for his efforts? It might rather be, of course, that Anaximander's efforts influenced the makers of the neo-Babylonian map. However, if the neo-Babylonian map pre-dated his, or was derived from an earlier tradition, he might have derived his map from theirs, but since various models had a


*Figure 4.11*

*Neo-Babylonian map, dating to the Persian period, c. 600–400* BCE long history in both Egypt and Mesopotamia[146] these might just as well have been the exemplars that he had in mind when he sought to rival them by making his own earthly map. Perhaps also, Anaximander knew of a map that Pherecydes made or had seen?[147]

The "how" issue is more complex. When Anaximander undertook the construction of an earthly map, he had little precedent. But this is not to claim that the map appeared *ex nihilo*. Homer's earthly map, the world-as-shield,[148] and the similar outlines suggested by Pherecydes' *Heptamychos*,[149] would not seem to be of much practical or cartographical use, but they also mark transitions toward such map making. Furthermore, Heidel thought that from Homer we could generate geographical outlines, but only the vaguest sort. Homer surely displayed a knowledge of routes between particular points, as when Odysseus wonders whether to sail homeward from Lesbos by keeping Chios to his left or right.[150] The cardinal points of north, south, east, and west were also certainly known to Homer and his seafaring compatriots. But with this knowledge could a map be produced? Heidel believed that it could not. Perhaps a system of coordinates could be derived from Homer, but an actual frame could not be produced; and without a frame, according to Heidel, there could be no map.[151] Nor could a frame be produced from a more or less complete wind rose that could serve comparably well as a compass card. Homer and his compatriots knew the winds—Boreas, Eurus, Notus, and Zephyrus[152]—and from them sailors could identify cardinal directions, but not a frame, for what was missing were indications of limits or boundaries.

Heidel's assessment, however, has been challenged indirectly by Bradford[153] and Severin,[154] both of whom suggested that an earthly map could be derived from Homer by means of an appeal to the navigational techniques of the ancient sailors. Severin, like Bradford, tried to recreate the sequence of travel by Odysseus; he supposed that the *Odyssey* was a sailor's story, a tale that betrayed a knowledge of galley sailing, and that its route followed familiar shipping lanes known since Mycenaean times. After trying to make the voyage, they concluded that the ancient sailors navigated from headland to headland, landfall to landfall, with relatively short stages in between. The frequent need of large crews in open boats to replenish water and find food and rest, required an appropriate navigational technique; that technique would inform the sailors of routes to inhabited locations, short distances from each other, known since the Bronze Age. Severin concluded that "[Homer] . . . did not think in cartographical terms, and may not even have had maps."[155] And that may well be so. But, from the assessment Severin presented, Homer and his seafaring comrades knew a series of geographical markers that dotted the seascape along the well-established shipping lanes; by connecting these dots, as it were, an outline of the *oikumenē* appears. Anaximander's innovation in cartography does not emerge *ex nihilo*; the navigational background of Homeric sailors provides an essential resource for the transition he effected in map making. What Anaximander seems to have transformed with these geographical markers, these well-known ports of call, was to organize an outline of the inhabited earth, and to do so within a new *frame*.

In order to produce a frame, the key ingredient was to mark out the limits. Anaximander achieved this crucial result by the use of a sundial that allowed him to fix precisely the risings and settings of the sun on the solstices, and perhaps the equinoxes,[156] as the altitude of the sun wheel got higher and lower in the sky, since this provided him with what he believed to be the boundaries of the earthly frame. Later, Aristotle used the very same technique when he set out his map of the earth in the *Meteorologica*; he guides the construction of the frame of the map by means of a geometrical construction, just like the ones preserved and perfected by his younger contemporary Euclid in the *Elements*. Some two centuries after Anaximander, Aristotle's discussion proves that the frame of the Greek map was still determined by markings yielded by a seasonal sundial: "Let point A be the equinoctial sunset, and the point B its opposite, the equinoctial sunrise. Let another diameter cut this at right angles, and let point H on this be the north and its diametrical opposite Q be the south. Let point Z be the summer sunrise, the point E the summer sunset, the point D the winter sunrise, the point G the winter sunset. And from Z let the diameter be drawn to G, from D to E. . . . [T]hings spatially farthest removed from each other are spatially opposite, and things diametrically opposed are farthest removed. . . ."[157] Why might Anaximander have, earlier, reached this same conclusion about the frame of the earth?

The prevailing mindset among archaic Ionians was that the horizon was believed to be fixed and not changing with the station of the observer.[158] The solstices marked out on that fixed horizon the limits or boundaries of the earth. Thus, both the wind rose and maps were defined by the horizon and that horizon was figured by lines drawn toward the risings and settings of the sun. The changes in altitude of Anaximander's sun wheel—the *tropai* or "turnings," and thus the seasons—were caused by the winds,[159] as Aristotle tell us and as is attested further by Alexander of Aphrodisias on the authority of Theophrastus, where Anaximander is identified by name as holding the view.[160] And Aristotle discusses in great detail, while defending his own assessment of the earthly map, how different winds are connected with the sun's changes in seasonal altitude.[161] Thus, the fact that Anaximander is credited not with a sundial but rather a *seasonal* sundial is especially telling. For it is by means of this evidence-producing device,[162] that he could mark out the limits of the earth, and so proceed to make his terrestrial map and earthly model. Seen from an oblique aerial view from Anaximander's round, flat earth, the regularities of solar motion and corresponding shadows cast would appear as in figure 4.12.

If we believe Herodotus's report, we know that Anaximander did not invent the gnomon, since he attributes the Greeks' knowledge of that device, as well as the celestial sphere and the twelve parts of the day, to the Babylonians.[163] But that report is suspect, not only because it appears as a curious digression in a book devoted to the history of Egypt, but also because the case has been made that the length of seasonal hours is more likely to be derived from an Egyptian practice of the New Kingdom, reckoning nighttime during the year to the rising of decans.[164]

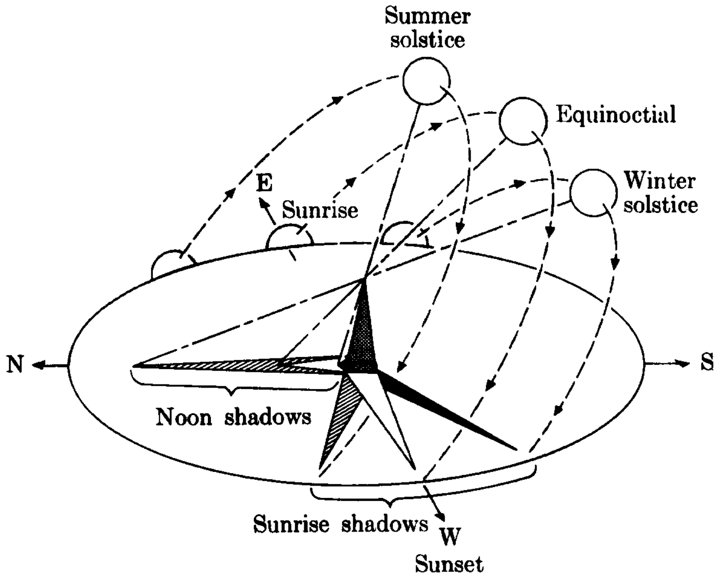


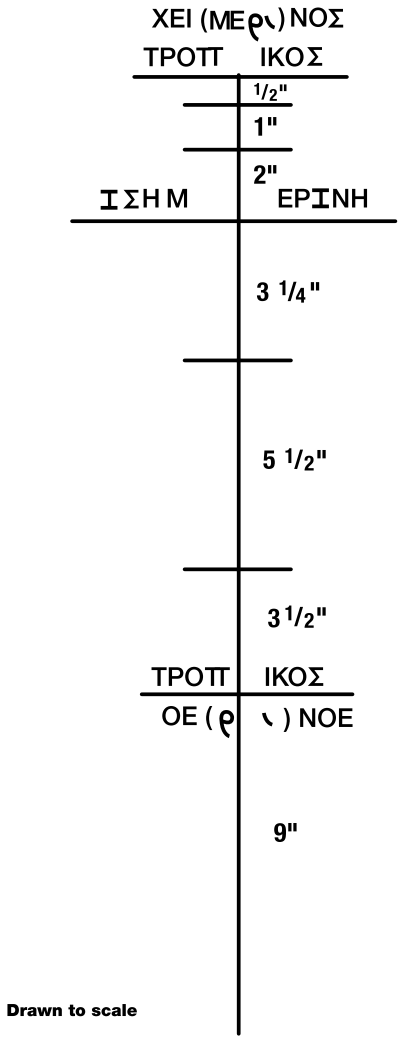

*Figure 4.12*

*Illustration of solar positions at solstices and equinoxes*

Indeed, Anaximander might also have learned techniques for constructing sundials from Egyptian sources, directly or indirectly; Egyptians had a long history of shadow clocks.[165] According to the report that we do have, preserved by Diogenes Laertius on the authority of Favorinus, Anaximander invented the gnomon and set it up ἐπὶ τῶν σκιοθήρων at Sparta.[166] Gibbs argued that this means that Anaximander's "gnomon" refers not to the vertical rod with which the term is familiarly identified but rather, in this case, is synonymous with σκιοθήρης,[167] and the testimony of Vitruvius proves it.[168] Thus, while Anaximander might not have invented the vertical rod used in "shadow catching," it is more likely that either he did in fact invent this specific type of sundial or introduced to Miletus such an invention, perhaps originally of Egyptian origin.

In any case, we can venture a guess about how his seasonal sundial might have looked. The earliest surviving sundial from Greece can be traced only to the Hellenistic period. The evidence consists in artifacts of both canonical and hemispherical examples. These, however, are unlikely candidates for providing a representation of Anaximander's sundial, for he imagined the earth as a flat cylinder and not spherical as these Hellenistic sundials would suggest. Gibbs conjectured that Anaximander's instrument "may have consisted of a pointed shadow-caster fixed perpendicularly to a straight meridian line, engraved on stone and divided according to the noon shadow lengths at various times of the year."[169] Such a device would have been able to display the solar regularities that were Anaximander's focus. The doxography reports that his device marked solstices and equinoxes; hours were not mentioned and it is doubtful that this device indicated them. There is a surviving artifact that may well be emblematic of Anaximander's seasonal sundial and that is an *analemma*. We have such an example, datable to the second century BCE, that has been suggested to perhaps convey the earlier model.[170] The zodiacal inscriptions appearing there, of course, could not plausibly belong to a sixth century sundial[171] but the markings of the *tropikos* (solstice) and *isēmerinē* (equinox) inscribed on the coping of a well on the island of Chios might indeed be characteristic of Anaximander's seasonal sundial. Opposite is a scale drawing of the device; the intervals in inches were recorded by Hunt and drawn to scale to fit the page presentation here.

When the frame of the map had been established by means of the sundial, Anaximander had next to identify the land and water bodies and to assign to them measures so that he could represent their sizes. While the specific details of the geographical features would take us too far afield,[172] the identification of the broad outlines is crucial. We can infer something about those broad outlines of the Milesian maps from the testimony of Herodotus. Born in Ionia and writing in the mid-fifth century, Herodotus was in an excellent position to see firsthand the Ionian map-making efforts traceable directly to Anaximander. When he ridicules earlier maps on the grounds that Ocean is drawn flowing round the earth as if it were turned on a lathe or even drawn with a compass, he is referring to an Ionian tradition extending from Homer to Anaximander and to his successor, Hecateus.[173] Moreover, it is also Herodotus who provides the evidence for the earlier tripartite organization of the earthly map when he declares, "I am amazed at those who have mapped out and divided up the earth into Libya, Asia, and Europe. . . ."[174] Herodotus complains about this threefold division because he believes that Europe is twice as long as the other two while being much less wide. The criticism makes



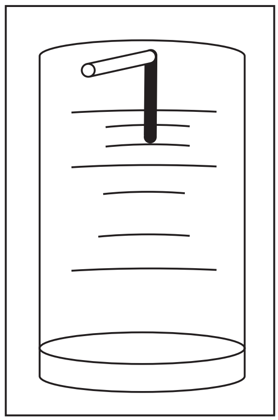



*Figure 4.13*

*A possible reconstruction of Anaximander's seasonal sundial following D. W. S. Hunt (1946), an analemma found in Chios, c. second century* BCE sense only if we suppose that the maps to which he is referring made the three parts of equal size. And those maps are presumably Anaximander's, or according to an account preserved by Agathemerus, the ones revised by Hecateus.[175] How shall we account for the threefold division of the earthly land masses? Like the cosmic numbers, perhaps the recurrence of the number three echoes again symbolic meaning or even utopian motivations; but it might just as well reflect a view commonly held among commerical traders and seafarers who passed through cosmopolitan Miletus. In whatever case, if Anaximander had put distances on the map he would have needed a set of abbreviations to do so; for this reason, Dilke wondered if perhaps Anaximander invented the Milesian or alphabetic system of numeration.[176] The rendition of Anaximander's map of the *oikumenē* that appears below follows Robinson with one substantial change, namely, that the earthly map is drawn upon his column-drum earth, and the Ocean/*anathyrōsis* image is striking.[177]

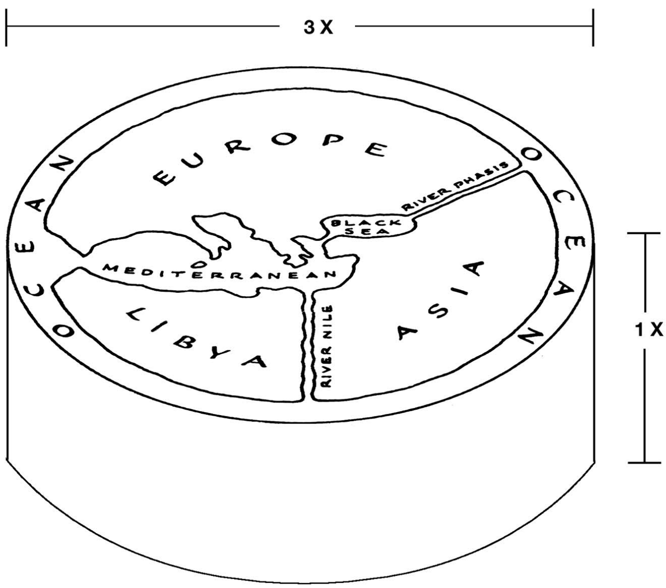



*Figure 4.14*

*Reconstruction drawing of Anaximander's map, on a column-drum earth*

Now, having presented an image of Anaximander's earthly map, a plan view, made possible by his innovation of a seasonal sundial, we turn now to consider the cosmic map/model projected vertically and obliquely. As we proceed three formidable problems need to be kept in mind, for they foster a better understanding about the conflicting, and often incompatible, orthographic views other than plan of Anaximander's cosmos. First, can we produce a picture of Anaximander's cosmos in three dimensions that incorporates the earth and all the celestial wheels? Second, when the changing elevations of the sun are factored in, can we decide whether they were a result of the changing inclination of the plane of the solar wheel to the earth, or whether the entire solar ring raised and lowered, throughout the course of the seasons, without changing the angle of inclination? And third, can we produce a view that provides a solution to the apparent inconsistency in the testimony that suggests, on the one hand, that Anaximander's cosmic frame was spherical, while on the other, that the cosmic frame was cylindrical. With these questions in mind, we turn to consider a selection of the scholarly drawings that attempt to reconstruct Anaximander's cosmos; the reader will see that they tend to focus on the relation of the solar wheel to the earth.[178]

Szabó[179] suggested an elevation drawing making use of the gnomon with which Anaximander is credited. The line AN represents the gnomon, NB′ is the shadow of the gnomon at local noon on the winter solstice, NS′ at the summer solstice, NE′ at the equinoxes. Szabó's diagram bears a striking resemblance to the *analemma* illustrated in Vitruvius;[180] that this was the source for his image is unmistakable (figure 4.15).

More than a century ago, an oblique image was proposed by Sartorius to represent solar motions.[181] The curious and ingenious model he presents proposes to account for the "turnings" of the sun by two different but simultaneous revolutions of the sun's wheel. The image is an oblique aerial view. The drawing has to be seen in perspective as the circle $S_1$ is in the foreground and $S_3$ in the background. The devastating critique, however, is

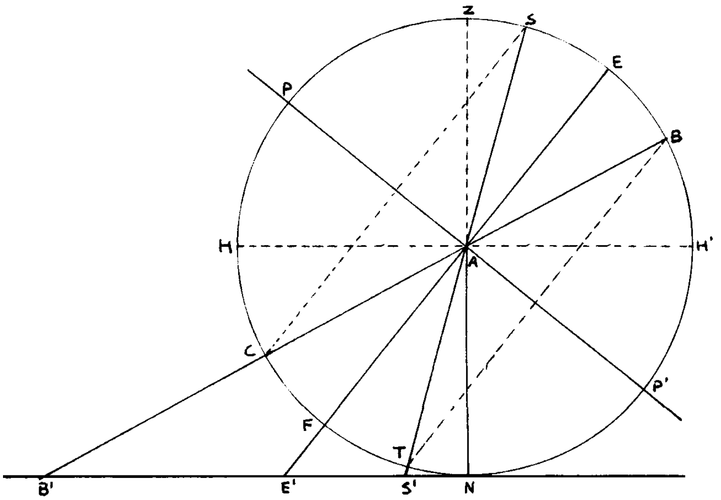



*Figure 4.15*

*Reconstruction drawing of Anaximander's cosmos, after Szabó*

that evidence for the epicyclical motion he suggests is to be found nowhere. There is neither evidence for a double motion nor any hint that the motion of the sun is any different from the singular motion of the star wheel, as his diagram implies.[182]

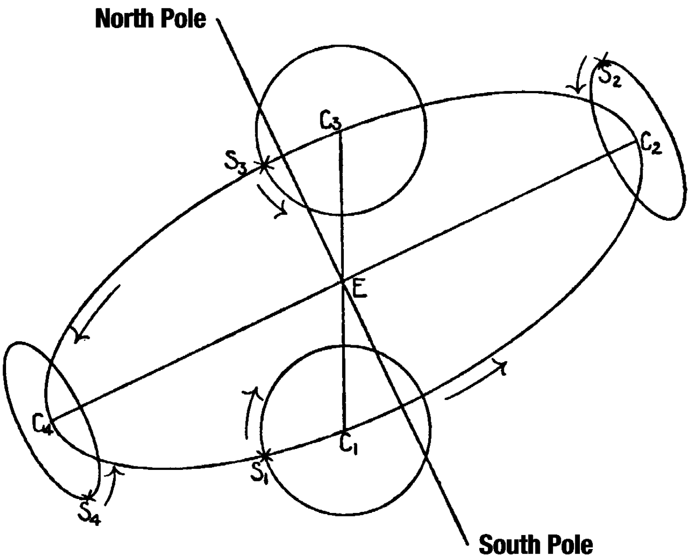



*Figure 4.16*

*Reconstruction drawing of Anaximander's cosmos, after Sartorius*

Neuhäuser[183] provides two different oblique variations of Anaximander's *geometrische Skizze* of the universe. In the diagram below, the sun's wheel is represented at the time of the winter solstice (BB′) as well as the time of the summer solstice (SS′). The root problem here is whether Anaximander imagined, in the turnings of the sun wheel, that the angle in which the sun is inclined to the terrestrial equator is itself changing. There is no evidence for that interpretation.[184]

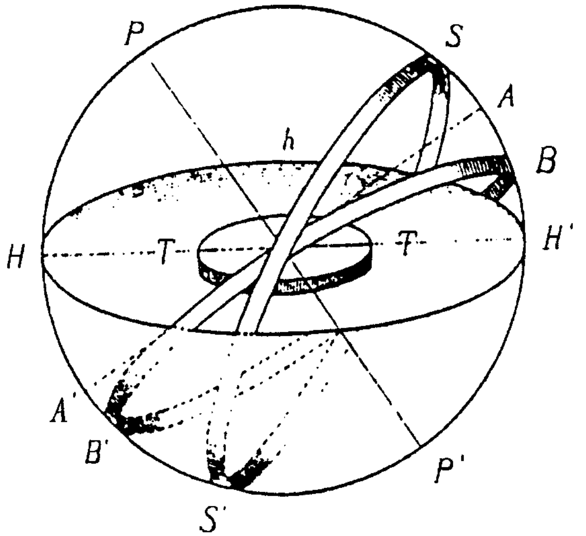



*Figure 4.17*

*Reconstruction drawing of Anaximander's cosmos, after Neuhäuser*

Heath[185] offered a simplified version of Neuhauser's oblique drawing. The flat cylinder is the earth (center O), N.P. and S.P. are the north and south poles respectively, the equator is the circle about AA' as diameter and perpendicular to the paper. The diagram suffers in two respects. First, it is only a partial representation since the wheels of the moon and stars are omitted. Second, although he criticizes Neuhauser on the grounds that his image supposes without any evidence that the angle of the sun wheel changes with its "turnings" and rather should be at a fixed inclination, his diagram suggests the very error he seeks to correct. Heath's image is committed to the view that the inclination of the sun wheel to the equatorial plane of the earth changes throughout the seasons, despite his protestations to the contrary.

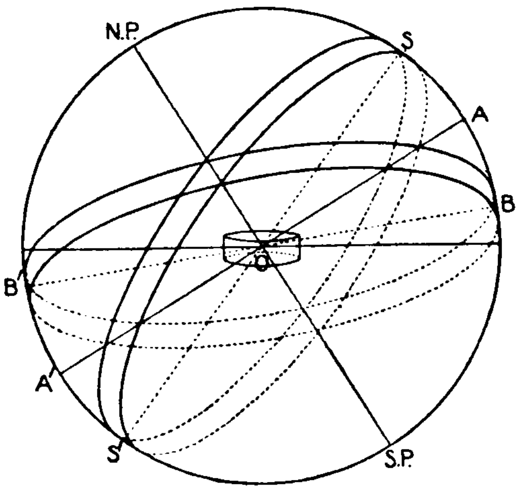



*Figure 4.18*

*Reconstruction drawing of Anaximander's cosmos, after Heath*

Next, we have the oblique illustrations by Mugler[186] and Krafft.[187] Mugler's illustration bears a resemblance to the one introduced by Neuhauser and refined by Heath, and it displays a stereometric representation. The wheels seem to represent the sun and

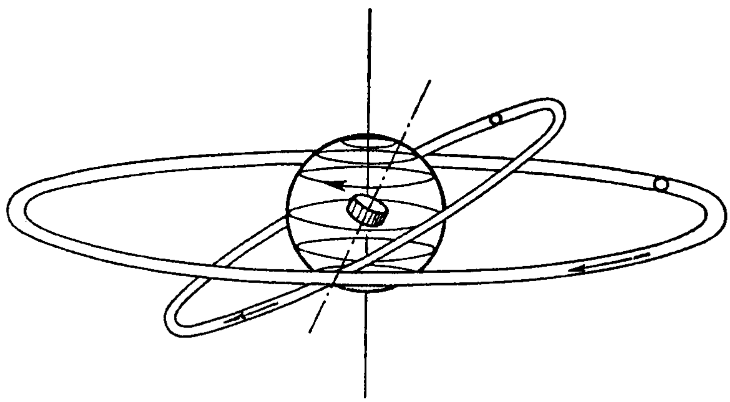


*Figure 4.19*

*Reconstruction drawing of Anaximander's cosmos, after Mugler* moon in their daily paths, as the arrows suggest a motion from east to west. The angle between the moon and sun ring, about 30°, is problematic. The daily circles of the sun and moon do not intersect, as the diagram suggests, but rather run parallel to each other. Mugler offers no defense for this particular difficulty that the diagram engenders. Nor does Mugler explain how, with a 30° variance instead of the more accurate 5°, the moon and sun would appear within the ecliptic, as they did to Anaximander and to us. Krafft's drawing is derived from Mugler's and thus shares with it the same difficulty.

Having surveyed an extensive sampling of scholarly efforts, we can now try to secure an adequate three-dimensional view of Anaximander's world picture. What must the adequate three-dimensional or oblique aerial view provide? First, the best picture would be the one that includes the earth and *all* the heavenly wheels. Second, it must provide a consistent account of the "turnings" of the sun—the solstices (and equinoxes)—without supposing that the angle of the plane of the solar orbit differs throughout the seasons, for there is no evidence suggesting such a change, as Heath and West rightly insisted.[188] And third, it must choose between the spherical model that has become common since Aristotle and the cylindrical model suggested by the tree metaphor as well as the cylindrical earth.

An excellent solution has been provided by Couprie,[189] and anticipated in a sense by Eggermont.[190] Furley believed the difficulties in presenting Anaximander's picture arose from two conflicting conceptions generated by the testimony of later commentators.[191] On the one hand, commentators have interpreted reports of heavenly wheels or circular rings to suggest a spherical cosmic frame, while on the other, the image of a tree suggested a cylindrical cosmic frame. What Furley did not consider, nor did any of the other commentators explicitly, was that Anaximander imagined the cosmos from more than one viewpoint, drawing, or model, as he might be expected to have done had he been influenced by routine techniques employed by the archaic architects when, on analogy with them, he imagined cosmic architecture. The plan versus three-dimensional approach adopted here illustrates how later testimony could become confused just as contemporary scholars, who have thought long and hard about the evidence and with centuries of scientific learning to aid them, nevertheless became confused in the process of producing their own renderings. The attribution of a spherical model to Anaximander is an anachronism plain and simple. Since the time of Aristotle—but also hinted at in the hemispherical heaven observed by Homer and Hesiod—we tend to take for granted the view that others, like Anaximander, must have envisioned the cosmos within a spherical frame. But, if the reader will approach the matter again with a fresh, unbiased, and non-anachronistic eye to Anaximander's wheels, one will see them, as it were, sliding up and down, and the cylindrical cosmos immediately appears. This is the virtue of Couprie's drawing; it is an axonometric projection, a kind of oblique drawing.

Thus, the main structure in Anaximander's cosmos is cylindrical.[192] The circular imagery is falsely generated by a misreading or misinterpretation of the plan view, or even a simple anachronism committed by later commentators who could not see the uniqueness of Anaximander's conception through the proliferation of spherical models of the classical writers, for the image of the column-drum and rings in the tree surrounded by the tree bark makes it unmistakably clear that the predominant image is cylindrical. Any cross-section, or plan view, of a column presents a circle; but when that circular image is projected back into the column, that is, *vertically and obliquely*, the structure is revealed to be cylindrical. The entire cosmos, consisting in column-drum proportions is, like a Russian doll, one within the other, a system of virtual cylinders within virtual cylinders, and the changes in altitude of the sun and moon is accounted for by their sliding upward and downward within these cylindrical frames without changing the angle of their orbital plane to the earth, as Couprie has illustrated and argued. To speak of *virtual* cylinders is to refer to the way that the heavenly wheels slide up and down around the axis of the heavens but not to posit the existence of such cylinders themselves. The turnings of the sun, driven by the winds, explain why the wheel of the sun is higher in the sky during summer rather than winter but, as West put it, "The seasonal changes in its (i.e., sun's ring) altitude cannot be accounted for by the tilting of this ring: it must rise and sink as a whole, while its angle of inclination remains the same."[193] With this conception, the sun wheel, retaining its inclination, slides up and down the virtual cylinder; so also for the moon. While the sun's projected cylinder must be 47° in height—that is, 23 1/2°, north and south—the moon's cylinder must be 57° in height. Inside the moon's cylinder is another for the stars, and this, as Couprie brilliantly suggested, must be a cylinder of infinite length so that looking up we still see the stars no matter what direction we look overhead.[194] The telescoping virtual cylinders turn at different speeds but they all turn in the same direction, from east to west. The combination of their daily rotation together with their sliding on their virtual cylinders accounts for their observed movements. Below is Couprie's solution,[195] an axonometric projection, with the column-drum earth inside the virtual cylinders, and the solar wheel, during solstices and equinox, retaining its angle of inclination.

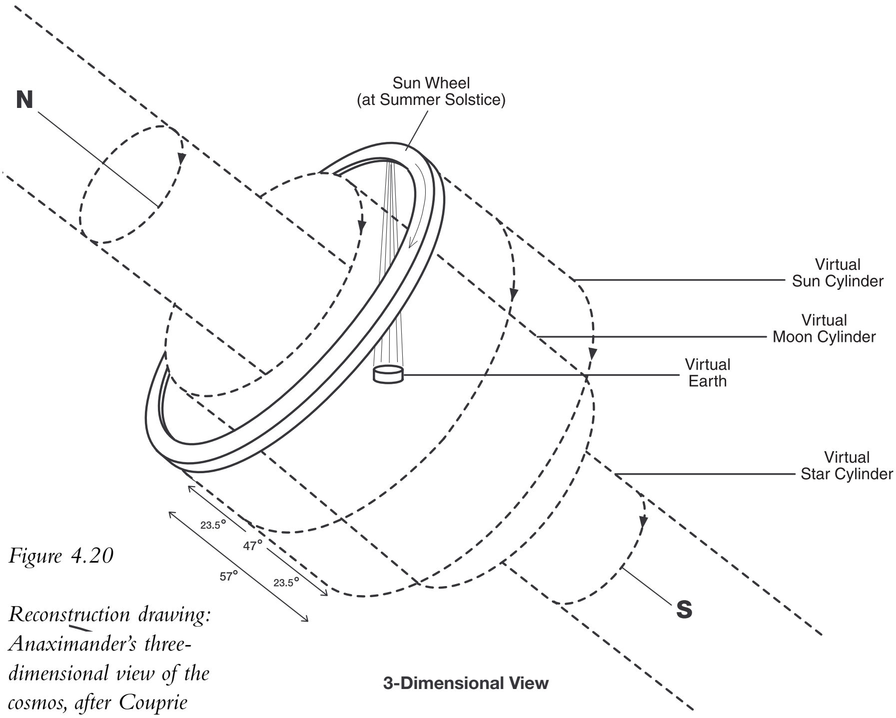



*Figure 4.20*

*Reconstruction drawing: Anaximander's three-dimensional view of the cosmos, after Couprie*

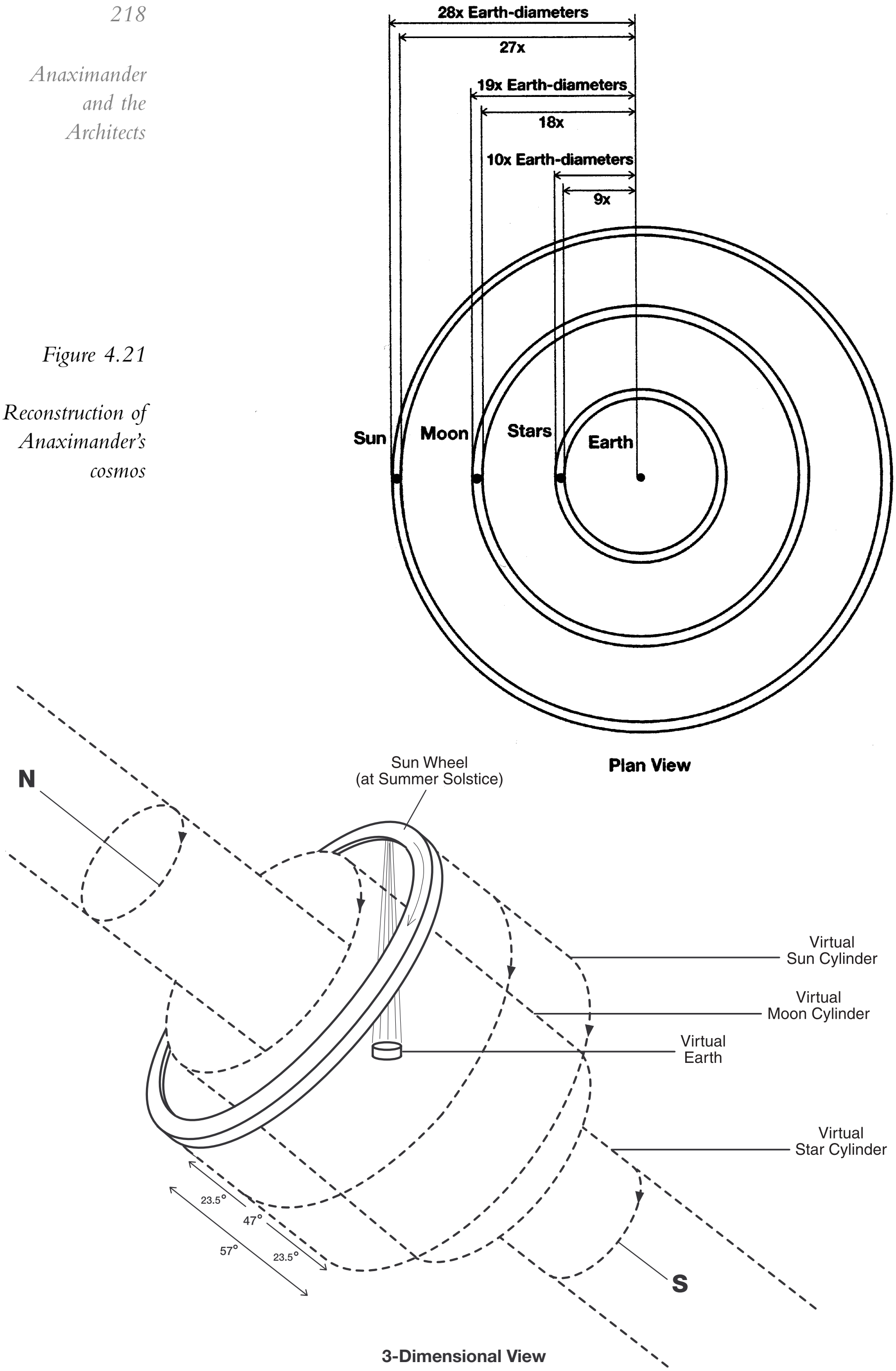



*Figure 4.21*

*Reconstruction of Anaximander's cosmos*

# 5

# *Technology as Politics: The Origins of Greek Philosophy in Its Sociopolitical Context*

## Re-Framing the New Narrative Account

An investigation of architectural technologies has enabled us to gain a new approach and new insights into the imagination of Anaximander, and thus into the origins of Greek philosophy. The initial clue was in the distinction between plan or aerial view, on the one hand, and all other views, including orthographic projections other than plan and three-dimensional views, on the other, with which the architects routinely worked. This point of departure, in turn, led to other considerations about architectural techniques and the rational, geometrical, and proportionate mentality that it fostered. Difficulties encountered at every stage of the building process promoted rational discourse, as their innovative solutions suggest. When problems arose at the quarries, or with their innovative devices to move great stones unearthed from them, or while setting drum upon drum for the columns that reached into the heavens, or installing the architraves at great heights and trying to set them securely, or when the building collapsed under its own immense weight, the architects pursued rational discourse and geometrically proportionate design techniques, not mythopoiesis, to answer the vast array of challenges. When the architects practiced their artful science, they refined and corrected their understanding when particular experiments failed. The architects, then, were engaged in activities that revealed physical principles of nature; their ability to work effectively required an understanding, not of the abstractions so characteristic of Greek philosophy but rather of *technē*, a hands-on knowledge, a vision of nature's law-like patterns and the ability to manipulate them in order to realize their plans. The success of these experiments, which the Greeks called *thaumata*, "objects of wonder," was measured not only in the beauty of the finished products but also in the stability of these colossal works that illustrated human mastery over nature. For these architectural creations filled the archaic audiences with the startling experience of wonder; while the temples dominated their landscape as expressions of an ultimately inexpressible divine power, they were at once monuments to the human capacity to grasp nature's comprehensible structure.

Whereas the familiar approaches to set out the origins of philosophical thought, explored in the first chapter, reflected upon the epistemological and ontological concerns presented in the systematic writings of Plato and Aristotle (the first tier), the second-tier approaches sought instead to discover the earliest stages that stepped away from mythopoiesis and embraced a newly emerging rational narrative couched in prose. In attempting to explain this second and earlier tier, our discussion sought to reveal the sources that motivated the rationalizing of Thales and Anaximander. Moreover, our discussion sought to reveal the background against which the innovations of Thales and Anaximander represented a meaningful departure. On Aristotle's account, the role of "philosopher" was new in archaic Greece, and so the question, "What established roles in archaic

Greece gave shape to their interests and highlighted by contrast their originality?" proved illuminating. The Milesian innovations do not emerge *ex nihilo*, as some scholars suggested earlier this century, but rather against a continuous and transitional background of ongoing activities. This new third tier we have explored offered us an answer to the questions: What activities in archaic Greece likely promoted Anaximander's rational mentality? Who else in his society was undertaking tasks in applied geometry—thinking in geometrical and proportionate terms and most especially in immense sizes, making drawings and models, measuring heights and distances, diverting rivers? And who else in Anaximander's Ionian community was writing prose books about such things? Our exploration of this new third tier opened a view to the architects within archaic society and suggested their influence on, and a community of interests with, the Ionian *phusiologoi*.

Given the rival hypotheses from the first-tier approach that offered to explain why and how Greek philosophy began—Leisure, Intermingling of Beliefs, Literacy, Technology, and the Polis—our task has been to explore farther the intersection of technology and the polis, not to undermine the lead of those such as Lloyd who eloquently organized the conventional view,[1] but rather to enrich our understanding of how these neglected ingredients contributed to philosophy's origins and development. The task that remains is to trace out the implications of these hypotheses by taking a long-view approach to the classical period. What are the plausible ramifications of these factors for our revised understanding of the origins of Greek philosophy?

The long view poses a complex task. It tries to make sense of the implications of these sixth-century changes for the fourth century in which Plato and Aristotle write systematically and become the focus for the familiar first-tier appraisals of Greek philosophy. For, on the one hand, the polis in Athens was not identical with the contemporaneous ones found elsewhere throughout Greece; and on the other hand, there are different spokesmen even for classical Athens who grasp their situation quite differently. The democratic and egalitarian measures that we tend to regard among Athens' greatest achievements were not equally distributed nor equally admired throughout the Greek world; Plato was no advocate for the democracy that put Socrates to death, and Aristotle was an outspoken defender of natural slavery. So, any account of the long view must recognize that the new narrative is complexly interwoven. This is because philosophical activity is embedded within a culture, and its innovative approaches stimulated certain social practices but not all of them; it reflected some trends but, at the same time, various philosophers were at odds with just those "enlightened" reforms. Thus, when we try to reframe the long view by examining Plato and then wondering how Anaximander's beginning brought us there, we must remember that this new narrative acknowledges the complexity of the development of philosophical activities within the sociopolitical structures.

The point of departure for the new narrative is the Greek temple, an invention of archaic Greece. The architects, either directly through their conversations or indirectly through their productions, stimulated the archaic Ionian communities not only with their *thaumata* but also with their techniques. Like the *xoanon*, the wooden cult statue that was chained down in the *naos* to prohibit its escape,[2] so also the temple itself, so to speak, chained down the image of the divine for it was the house befitting—the manner of establishing for the community—the highest and best. It is to the temple that our discussion must return again but this time with a new agenda. Since temple building allowed the architects to come to center stage so that they could affect Anaximander and his archaic community, we must now ask new and penetrating questions about who brought the architects to that stage and why: Who paid the architects? Why build monumental temples, and specifically to Hera, Artemis, and Apollo? And what did the patrons believe they were getting for their enormous expenditure? In answering these questions we explore *Technology as Politics*.

## The Aristocratic Patrons of Archaic Temples

> There is, therefore, some probability that building programmes in the archaic period were organized rather differently from the later ones which we know more about. The importance of aristocratic individuals and families, as providers of funds, as contractors for (and so as supervisors of) whole buildings, and presumably also as instigators of building, was very much greater, and the architect must have dealt more often with the individual or family concerned than with the state.
>
> —J. J. Coulton, *Ancient Greek Architects at Work*

While the familiar view, resting on a wide variety of evidence both inscriptional and literary, is that building projects in the classical period were publicly sponsored and administered, it seems likely that these projects were not organized in the same fashion in the earlier stages of monumental temple building, although the definitive evidence is exiguous.[3] What we do know is that a central and significant source for temple patronage in the archaic period and most especially in eastern Greece came from special individuals, be they aristocrats, tyrants, or royalty.[4] Coulton notes that while building inscriptions listing contributors and their donations provide good evidence for patronage from the fourth century BCE and later, there is little evidence in the fifth century and none in the sixth, when the very idea of permanent civic records had scarcely developed.[5] But Coulton also reasons that if personal and family prestige is a proven source of patronage in the Hellenistic period, the practice was likely part of the social fabric earlier; as he put it, "In the archaic period when prestige-loving aristocrats held most of the city's wealth, their financial support, whether as individuals, as families, or as clans, must have been vital."[6] But even if we accept the primary role that the aristocrats likely played as patrons in archaic temple building, we must still ask why they took on this enormous expenditure. Over and above the commonly accepted thesis that the temples played a social role by bringing together the disparate members of these communities through regularity of worship,[7] there remains the question of—for lack of a better phrase—what was in it for the patrons? The answer is commonsense clear: to enhance their own esteem, to further their social power, and to further claim civic authority in times of increasingly unpredictable upheaval and challenges to their authority.

Herodotus[8] tells us that the rebuilding of the temple of Apollo at Delphi (burnt in 548 BCE) was let out in a contract for three hundred talents, the round number suggesting that it was let out in a single contract rather than the addition of many small contracts, one to another. Coulton argues that the contract must have been let prior to 526 because it preceded the fundraising effort in which Pharaoh Amasis was a significant contributor. Coulton observed that it was doubtful that any Greek city of the archaic period would have had the administrative machinery to supervise so large a project in detail, as was the case come the fourth century about which we are so much better informed, and so the likelihood for aristocratic/tyrannical/royal patronage and supervision is so much more plausible. Indeed, from what sources other than aristocratic/tyrannical/royal patronage could three hundred talents (that is, 1,800,000 workman-days wages) be readily produced in the archaic period? Coulton offered the view that "[t]he single contract was probably taken-up by the Alkmaionids, an aristocratic Athenian family who were in exile at the appropriate time. . . ."[9] We also know from Herodotus[10] that the Alkmaionids were the responsible supervisors for the construction from an early stage. The claim for the prominence of aristocratic patrons in projects of monumental temples in the archaic period, as opposed to public building projects, is further supported by the inscriptions on the column bases of the archaic Artemision that acknowledge Lydian King Kroisos as "dedicator."[11] The rebuilding of the Dipteros II under the auspices of tyrant Polycrates in Samos—alluded to by Aristotle[12] as "works of Polycrates," where the motivation is identified as strategies to keep the populace poor and preoccupied, but certainly fulfilling its social function of uniting the populace and enhancing the patron—also seems to support the thesis of aristocratic patronage.

We also have intriguing accounts of aristocratic supervision in monumental building projects, reported by Polyainos,[13] of how Phalaris made himself tyrant of Akragas, and Theron did so likewise. Phalaris (570–565) was supervisor for the construction of the temple of Zeus on the acropolis of the city. He was entrusted with two hundred talents (again, like the account in Herodotus, it sounds as if it was let out in a single contract) and hired a large bodyguard and organized a huge assemblage of construction materials on the elevated site. But, instead of building the temple, he instead fortified the acropolis and seized the city. Polyainos makes the same claim about Theron. While some scholars have doubted the second case as too similar, Coulton pointed out, in defense, that "a good trick is worth repeating and the temple concerned is of an appropriate date."[14] Most importantly, both men, like the Alkmaionids, were aristocrats. So, the archaic evidence we do have includes aristocratic/tyrannical/royal patronage for temple building—Pharaoh Amasis and King Kroisos, tyrant Polycrates, and aristocrats such as Phalaris, Theron, and the Alkmaionids.

The defense of this claim for a more prominent role of aristocratic patronage in archaic building projects can also be made by appeal to the testimony of Plutarch in the *Lives* of Themistocles and Pericles. Plutarch makes the point that while the populace of fifth-century Athens wanted illustrious leaders, they also did not wish them to be too illustrious. Because Athenians feared the dangers of men who had become too powerful, ostracism became a growing institutional practice. Themistocles is pictured as a man consumed by a vision of glory and public honor. The final straw, as it were, that provoked the Athenians to banish him at length, was his patronizing the building of a temple to Artemis.[15] So also for Pericles; he met vehement resistance in the popular assemblies in response to his prerogative to continue the patronage of building projects.[16]

What reasonable conclusions are we entitled to draw from these accounts? Given this cluster of evidence from the monuments, Herodotus, Polyainos, and Plutarch, it is reasonable to infer that aristocratic patronage of temple projects had been routine in the archaic period, that aristocratic individuals played a more central role in funding and supervising these extraordinarily large and expensive enterprises in the sixth century, that aristocrats grew in power and esteem by and through this patronage, and that the populace, in fifth-century Athens and elsewhere, urged public patronage of building projects to diminish the power that would customarily accrue to these aristocratic patrons.

## Technology as Politics: The "Argument" for the Appropriation of Civic Authority

In order to grasp the motivation for temple building in Ionia, we must come to grips with what Vernant aptly calls the "crisis of sovereignty" in the archaic world. To see this we must work our way backward, taking the long view as it were, posing a problem concerning human excellence for Plato—the self-realization model—and then reflecting to consider the earlier prevailing model of excellence, the genealogical or inheritance model of *aretē*. Finally, in order to see how temple construction was motivated by a variety of agendas, some of which ironically backfired, we examine the political motivations and the struggle for power to understand why aristocratic patrons financed these very costly monumental temples.

The readers of Plato's dialogues are confronted time and again with the questions "What is *aretē* ('excellence' or 'virtue')?" and "Is it teachable?"[17] To achieve excellence is to be *kalokagathos* and this is no simple feat. Plato and the Greeks of the classical period were preoccupied with the identification and attainment of *aretē*. In the Platonic dialogues there is mention from time to time of a person or persons who are supposed to have achieved excellence. The readers are challenged over and over again by one thorny argument that purports to show, more clearly than any other, that excellence cannot be taught. That case is the one whereby a father—be it Themistocles, Aristides, Pericles, or Thucydides—is supposed to be virtuous and yet his children fall decisively short of attaining virtue.[18] Now, how can this be, Socrates wonders, if excellence is really something teachable. For a father would surely wish to impart the most valuable things to his sons, and excellence is perhaps the most valuable of all attainments; thus, if the father is in possession of *aretē*, he would certainly impart it to his sons if it were teachable.[19] But, since the sons of apparently virtuous men have more often than not failed to achieve this splendid excellence of character, then this most prized *aretē* is evidently not teachable.

Plato's preoccupation with this problem becomes clearer when it is seen against the background of the traditional view that *aretē* is inherited, what may be called the "genealogical model of excellence." This competing traditional view, which informs the cultural background, held that the sons of the best men, from the highest classes, are sanctioned to inherit positions of authority because the essential mark of virtue is family lineage. This idea, characteristic of the archaic aristocratic ethos, is deeply entrenched in Homer's *Iliad*. It is one that permeates the so-called Catalogue of Ships in *Book II* when each man's excellence finds expression in his genealogy, tracing an auspicious lineage not only from heroes but often from the gods themselves.[20] In *Iliad VI*, when on the battlefield, Diomedes, the spokesman for archaic Greece, meets Glaucus, the spokesman for the Dark Ages, he asks him, "Who are you?"[21] When Diomedes asks the question, so far as he can, what he wants to know is Glaucus's lineage. For Diomedes, the genealogical line traces and confirms one's excellence. Glaucus's response is to suggest that he forget about lineage; for him, self-identity and human meaning consists, ultimately, like the rest of nature, in the great cycles of the seasons that bring birth, growth, flowering, and death to all living things. By stark contrast, for Plato's Socrates, excellence is certainly not inherited and in no way guaranteed by lineage, nor is it delivered in the great cycles of nature. Rather, excellence consists in a kind of self-consciousness and self-realization that a person must attain by his own efforts but that cannot be inherited, nor can it be acquired by a kind of osmosis by sitting near to someone else.[22] Plato articulates a vision of human meaning distinct from the one expressed in Homer, a meaning captured in the famous expression uttered by Socrates in the *Apology* that "the unexamined life is not worth living."[23] According to this new view, the self-realization model, the highest human excellence results from one's own making, and it consists in a reflective self-consciousness—a defining mark of the first-tier accounts of philosophy—that distinguishes us not only from all other living things on the earth but also from members of our own species whose failure to achieve this rational self-awareness is a sign of their deficiency. Thus, while Homer's Diomedes, the spokesman for archaic Greece, believes that lineage suffices to guarantee excellence, Plato, speaking in the classical period, rejects the older formula. By so doing, he has rejected the genealogical or inheritance model of excellence.

Somehow, in the few centuries that separate Homer from Plato, a transition was effected in the social mentality that allowed Plato the vision to reject the older model. No doubt, there were many of his aristocratic contemporaries that still held tenaciously to Diomedes' point of view. But the phenomenon of Plato's rejection of it suggests a transition in prevailing mentalities traceable to the Milesian *phusiologoi* such as Thales and Anaximander who opened the way by emphasizing rational discourse and thereby elevating the role of human reason, expressed in prose. In order to see this transition, part of the new narrative of the origins of philosophy, we turn to explore the background in which the archaic mentality itself unfolded and crystallized. This brings us to examine the so-called "crisis of sovereignty."

In the Mycenaean world, pointed to in the dactylic hexameter of epic poetry and in the reconstructions based upon archaeological finds, political authority was directed by the *wanax* or chieftain who inherited his kingship.[24] This political institution exhibits a genealogical model of *aretē*. The *wanax* was granted the right to authority on the basis of his excellence and that excellence was understood to be an expression of a purportedly divine connection inherited through lineage.[25] The *wanax* was thus a divine descendent who made the law, interpreted it, and enforced its provisions. The fall of the Mycenaean civilization c. 1200 BCE was at the same time the collapse of the central palace civilization in Greece,[26] and with it was born a new political problem: who should rule and by virtue of what authority? This is, to use Vernant's parlance, the crisis of sovereignty.

The drastic depopulation following the collapse of the central palace civilization seems to have been followed by a return to small tribal organization, the ethnos.[27] On the Greek mainland, this social system seems to have predominated in the period commonly referred to as the Dark Ages, roughly 1100–900 BCE. But, come the eighth century, the beginning of what we refer to as the "Archaic Period," there seems to have been substantial growth in the population, perhaps quadrupling it.[28] And it was here that the struggle for authority became a newly formed problem. Those already in positions of authority, the chieftains of the tribal families—the *ethnos*—were aristocrats, and they found themselves increasingly under pressure to relinquish authority. After all, it became an issue of contention to wonder why *they* ought to rule. And if they did, by what right? The fall of the central palace system had effectively undermined the view that one individual, by virtue of divine lineage, had the right to sovereignty.[29] In many quarters of Greece competition for land became great and various strategies were developed to try to retain whatever authority one had succeeded in marshalling.

Competition for land, with the increasing importance of land ownership for citizenship, was a strong motivation for colonization.[30] Many men set out for the new land in Asia Minor and southern Italy in their hollow ships. On the mainland, as Snodgrass pointed out, an interesting chapter unfolded in aristocratic efforts to secure eroding authority. With the reintroduction of metallurgical techniques made possible by the resumption of trade and commerce with the East, aristocrats, fighting off neighboring factions, heavily armed their own townspeople to combat insurgents. This was the creation of the *hoplite,*[31] "the heavily armed foot soldier." The practice was unusual and innovative because it brought common people into the fighting arena whereas previously such actions had been largely the province of the aristocracy alone. The creation of hoplites thus also created a new problem of military strategy and the new solution was the formation of the *phalanx* to direct masses of men on the battlefield.[32] This new military organization also contributed, in an initially unforeseeable manner, to the undermining of the traditional heroic ideal and consequently the oligarchic vision of aristocratic authority it fostered. The heroic ideal as it is displayed in Homer's *Iliad* highlights an individual—Achilles, Ajax, Hektor, Odysseus, Glaucus, Diomedes, and many others—who steps forward from the ranks of men to face the enemy, to fight one on one, to live or die. On the contrary, the phalanx must discourage this type of heroic individualism if it is to be successful, and quite literally each man's very life depended upon it. The successful employment of the phalanx has as its *aretē* the mutual cooperation among men; it promotes a democratic and egalitarian ideal, not an oligarchic one. With shield in the left hand and spear at the ready in the right, each man is protected by the shield held by the man directly to his right side. This military arrangement is effective only so long as each man holds the line in unison with his comrades. Cooperation and a mutually recognized *isonomia,* not heroic individuality, is the required human excellence.

Now this was all well and good from the perspective of aristocratic strategy to secure their land and authority against challenges from neighboring factions. But what happened in a year of drought, with foodstuffs kept within the aristocratic fortification, when fifty or sixty aristocrats found themselves with a thousand of their own heavily armed foot soldiers banging furiously at their doors? A new equality began to dawn as the aristocrats, believing that they were securing their eroding authority, found their strategies had backfired. The result was a further erosion of aristocratic authority and the oligarchic vision it embraced. As Snodgrass eloquently stated the case:

> This change [the invention of the hoplite], great in its implication, must not be regarded as revolutionary in intention: as it was defensive militarily, so it was politically neutral as a conception. By calling on others to join them on the battlefield, the aristocrats can have had little notion that they were jeopardizing the structure of society.[33]

It is this sort of breakdown of archaic aristocratic authority that constitutes the penultimate result of social reform en route to the increasing egalitarianism and *isonomia* of the classical polis. Of course, some of the aristocrats might have grasped immediately that arming their townspeople would alter the customary balance of the classes, and that the creation of the hoplites forced them to imagine an increasingly egalitarian society, right from the outset. But it is just as likely that many of them did not see fully the long-term consequences, or could not anticipate the far-reaching social change of their strategy to defend themselves against neighboring factions and immediately pressing hostilities. Thus, while the aristocrats did continue to enjoy a privileged status in the polis, the social structure underwent transformation. The result was that power and authority were shared increasingly by more persons than the earlier archaic society allowed, and it is difficult to believe that this had been their intention when they first heavily armed their townspeople to join them on the battlefield.

The case of the hoplite highlights the changing fabric of social and political relations in archaic Greece. Vernant also invites us to see these changes as characteristic for the whole of Greek society, and consequently, the general decline of what had been traditionally aristocratic prerogatives and authority.

> This account strikingly illustrates a psychological attitude that is evident not only in the realm of warfare but on all levels of social life, an attitude that marked a decisive turning point in the history of the polis. There came a time when the city rejected the traditional modes of aristocratic behavior, which tended to exalt the prestige of individuals and of the *genē*, reinforce their power, and raise them above the masses.

> Thus, it condemned as excess, as *hybris*—in the same category as martial frenzy and pursuit of pure personal glory in combat—the display of wealth, costly garments, magnificent funerals, excessive displays of grief in mourning, behavior that was too flamboyant in women or too confident and bold in aristocratic youths.[34]

Vernant emphasizes the important social changes heralded with the growth and flourishing of the polis from the seventh through fourth centuries. As the polis grew, those who made up the city, however different in origin, rank, and function, appeared to be "like" one another. "This likeness laid the foundation for the unity of the polis, since for the Greeks only those who were alike could be mutually united by *philia*, joined in the same community."[35] While the earlier relation—the traditional aristocratic ethos—between people was, according to Vernant, hierarchically ordered by dominance and submission, the new framework of the city required reciprocal relations. Here, all men were *homoioi*—men who were alike—and later *isoi*, equals. Thus, Vernant can say that "[i]n the sixth century this image of the human world was precisely expressed in the concept of *isonomia*."[36] But two things must be noted. First, in Samos and Asia Minor these changes were slower to catch hold as their peculiar though less well attested histories suggest; and second, the background for these sixth-century transitions must be seen against a horizon of a more fundamental inequality. Vernant, following Ehrenberg,[37] offers to trace the rise of such egalitarian reforms to an earlier aristocratic transition in which, wresting authority away from the absolute power of one man (the *monarchia* or *tyrannis*), the aristocrats described their oligarchic regimes in terms of *isonomia* and *isocratia*. "In this regime, *archē* was reserved for a small number to the exclusion of the majority but was divided equally among members of that elite group."[38] The manner in which *isonomia* acquired such strength by the end of the sixth century so as to enable any member of the *demos* to have access to civic offices, according to Vernant, rested on this older tradition and the kind of psychological appeal these egalitarian sentiments had for its aristocratic proponents.

Vernant helps us to see that participation in public affairs, prior to the middle of the seventh century, was connected to military qualifications, and those were established by the aristocracy of the *hippeis*. But, with the rise of modifications of military equipment and the invention of the hoplite, the aristocratic figure of the warrior was transformed. What was formerly an exclusive aristocratic privilege vanished with the democratization of the military function, and with it the old warrior ethic. What counted for the aristocratic *hippeis* was "individual exploit, splendid performance in single combat,"[39] the face-to-face battles between *promachoi*, and military worth, *aristeia*, was asserted in a wholly personal superiority. But the hoplite no longer engaged in individual combat. "If he felt the temptation to engage in a purely individualistic act of valor, he was obliged to resist it. . . . He was trained to hold ranks, to march in formation . . . to take care not to leave his position at the height of the battle. Martial virtue, then, no longer had anything to do with *thymos* but consisted in *sophrosynē*—a complete mastery of self, a constant striving to submit oneself to a common discipline."[40] Hence, Vernant can reach the conclusion that: "The phalanx made of the hoplite, as the city made of the citizen, an interchangeable unit, one element like all the others, and one whose *aristeia*, or individual worth, must never again be demonstrated except within the framework imposed by coordinated maneuvers, group cohesion, mass action—the new instruments of victory."[41] Thus, with the decline of what had been rather exclusively aristocratic authority, new formulations of human being emerged within the new social polity.

The breakdown of this traditional aristocratic authority was also signalled by the rise of tyranny throughout Greece.[42] These challenging events were generally short-lived, taking place in the seventh, sixth, and fifth centuries, and signify an intermediating chapter in the developing egalitarianism of the polis. In this sense, the rise of tyranny, like the invention of the hoplite, represents a penultimate stage that punctuates the growing *isonomia* and democratization. The advent of tyranny, Aristotle tells us, initially took the form of a defender who rose from the ranks of the common people to protect them against the excesses of the nobles.[43] But we also know that the history of archaic tyrannies is replete with examples in which some member of the aristocracy, and not the common people, engineered a *coup* and installed himself as tyrant. While the earliest chapters may give witness to the popular support for tyrants who helped balance the greed of traditional aristocracies,[44] that enthusiasm soon gave way when the tyrannies consistently led to their own unjustifiable excesses.[45] The important point for our discussion is that the traditional model of *aretē* the genealogical or inheritance model championed by the ruling aristocracies, was progressively challenged by new candidates who claimed excellence and hence a right to authority.[46] The origins of Greek philosophy take place within this context of social and political upheaval and transitions.

Besides the creation of the hoplite and the rise of tyranny, another attempt to secure an eroding aristocratic authority was undertaken: archaic temple building. In this sociopolitical "experiment," efforts to secure land ownership were achieved through the development of cult sanctuaries and through the building of monumental temples.[47] The archaeological record supplies evidence in the eighth century, and following, of both the archaic invention of the temple and the rise of cult dedications, especially in an assortment of metal votives.[48] The techniques required for both enterprises were certainly imported, from Egypt and the East, and both proved to be steps toward the consolidation of the many factions that comprised the social organization and thus proved to be formative developments in the polis. The growth of the central sanctuary and sixth-century monumental temple constructions in Ionia were part of this larger program to consolidate the divergent factions through the regularity of worship.[49] The social unification programs of the sixth century shared the same general strategy with the earliest philosophical projects of the archaic period, namely, the search for one over many. But another part of the aristocratic agenda in financing monumental building projects was to bolster their own advantage, in what we may call the appropriation of civic authority. To see this particular motivation for aristocratic patronization we turn first to consider the general strategy toward securing control of land.

As tribalism, traditionally connected with stock raising, began to decline with the rise of the polis, we find the flourishing of granaries connected with arable farming. This is quintessential to emphasize because "in the classical era of Greek history there is no closer link than that between citizenship in the polis and ownership of land."[50] As the population continued to increase, there was a comparable increase in demand for arable farming as opposed to stock raising in order to feed the bursting new population. The result was a greatly heightened competition for land and a great escalation in disputes over land ownership.

> Repeatedly, when the Greeks of the historical period engaged in land disputes, we hear of them having recourse to the legendary past as a source for justification: if a party could claim to be linked by descent or other close association, plausibly or even implausibly, with a legendary personage who had once inhabited a place, then their claim to ownership of that place was greatly enhanced . . . but the trump card was the physical discovery of a legendary hero, in the form of a skeleton in a tomb.[51]

Snodgrass's assessment finds support in various reports by Herodotus in which disputes over land ownership sought resolution by one party who claimed special descent from, that is genealogical connection to, either god or hero in that geographical location. Spartan Lichas, for example, turned the tide in the war against Tegea when, with the help of the Delphic oracle and a garrulous Tegean blacksmith, Lichas "located" the bones of Orestes and brought them back to Sparta.[52] Anti-Argive Cleisthenes, tyrant of Sikyon, persuaded the Thebans to exhume the bones of the hero Melanippos, deadly enemy of Argive Adrastos, so that he could re-inter the bones at the cult site and so drive out the cult.[53] A similar case has also been made for the social and political motivation to make dedications at "supposed" Mycenaean/hero graves; the archaic Greeks were in no position to know the historical realities of their Mycenaean predecessors who lay hundreds of years in the past. But "historical realities" were not the issue; leaving dedications at supposed hero graves was politically motivated. And so was the development of the sanctuaries. By instituting a cult of a local hero, or the building of a monumental temple to Hera, Artemis, or Apollo, "a community could acquire a sense of security in an age of apparently fluid and unpredictable settlement."[54]

Now, in Miletus the circumstances were not identical to those on the mainland. For one thing, the tyranny arose from the prolongation of the chief magistry, the *prytaneia*, which may have reflected the power given to the *aisymnetes*, "elected ruler," at the time of the fall of the kingship.[55] But with regard to competition for land, it seems that Miletus and greater Ionia shared considerable similarity. Just as on the mainland the lack of arable land and the importance of land ownership for citizenship motivated colonization, so also the founding of an extraordinary number of colonies helps to confirm that here, too, competition for land seems to have been great.[56] While the picture we get of Miletus at the end of the seventh century BCE is commercially vibrant, seagoing, and trading, our picture also includes the downside of mercantile success. However thriving Miletus was, the more interesting it would be to nearby kingdoms that sought its riches. Herodotus informs us that the Lydian succession of Gyges to Ardys to Sadyattes to Alyattes to Kroisos attacked Miletus again and again.[57] In order to establish the strongest claims to their land, the leading Ionian cities such as Miletus, Samos, and Ephesus built monumental temples as a sign of their right to authority over these geographical locations. It was the aristocratic families, or what amounts to the same source of patronage, the tyrants who pushed them aside, who were likely the major players in funding these enormously expensive archaic projects.

In the archaic period, as we have already considered, building was not sponsored by the public at large. The primary patrons of these central sanctuaries and monumental temples were special individuals, most usually aristocrats, since they controlled the land in the first place. By the classical period, however, we recall the perceived affront to the Athenians when Themistocles or Pericles seemed to be attempting to continue just this aristocratic prerogative. Pericles offered to assume the full burden of patronage for the Athenian building projects. Rather than take public funds, he offered to supply his own and make the inscriptions of dedication in his own name.[58] One interpretation of the assembly's rejection of Pericles' proposal, which caused them to shout out and insist upon using public funds instead, was the Athenians' perception that Pericles sought further to arrogate civic authority. The picture here is that the more egalitarian community resented the aristocratic patronage of building projects. For in such patronage the Athenians saw a strategy to secure an unfair advantage in the delegation and exercise of civic authority. This "unfair advantage" was likely a significant part of the aristocratic motivation for the patronization of the temples in the archaic period.

Thus, we come to see another side of the sociopolitical motivation for archaic temple building besides the integration of the divergent factions of the community through the regularity of worship. The building of these colossi was an "argument" for the appropriation of civic authority, in general, and the control of land, in particular. While the development of the sanctuary was part of the social consolidation program, the monumental temples were financed by the aristocrats to bolster their diminishing authority. Most especially, temple patronage needs to be seen in the context of disputes over, and challenges to, aristocratic land ownership. As Starr put it, "The economic power of the [aristocrats] rested on one simple fact: they controlled the land."[59] When that control was progressively challenged, new strategies were formulated, such as the invention of the hoplite and the monumental temple, to meet the challenge, to keep control of the foundation of their economic power. The temples, of course, were designed to impress outsiders and would-be raiders, but also tried to draw a special connection between the patrons and the particular deity—Hera, Artemis, Apollo—to secure their claim to the land. The Spartan Lichas or the anti-Argive Cleisthenes employed the same strategy, a broad appeal to the genealogical model of excellence.

But the temple, unlike the hero cult, implicitly made an appeal to another "argument" for the right to appropriate civic authority. The aristocratic ethos sung by Homer was also testimony to a religious dogma, namely, the statement of an ultimate human incapacity, and thus a call for the preservation of the status quo. Aristocratic Odysseus offered the advice to mortals, "In a world of chaos and confusion, the best advice for mortals is to suffer in silence, to accept the gifts they have been given."[60] No man knows when misfortune shall replace fortune, when luck will desert him in his time of greatest need. The best course is to appreciate whatever goods one has at present, to recognize that these modest gifts, too, may disappear, and thus not to rock the boat. Hera, Artemis, and Apollo all remind men, albeit in different ways, of the impoverishment of mortal wisdom in comparison with the divine. In the ultimate analysis, in front of the god, human understanding is next to worthless. The ethos that drove the patrons of monumental temples in archaic Ionia was the pessimism of reason, the view that nature's deep secrets cannot be discovered by the minds of mortals, and through the sacred sanctuaries the inscrutable wisdom of the god is celebrated. However, as Snodgrass helped us to see in the creation of the hoplite, so also here, the aristocratic effort to bolster an eroding authority backfired. For the aristocrats paid the architects, brought them to center stage to build monuments to their "unfair advantage," to create *thaumata* to preserve the status quo by reminding the community to accept their situations. The intended message was that the aristocrats are rulers and should continue to rule, and the masses should be content with their lot because human reason cannot penetrate further into nature's order: as nature has so divided benefits and burdens so also should convention follow. But, in the process, the architect's productions and innovations revealed a world of relations that could not be incorporated within the human horizon projected by the epic mentality. The programs in monumental architecture opened up unexpectedly a domain of human investigations into nature and promoted an optimism of reason that Anaximander pursued by producing a rational vision of knowledge that, in turn, progressively challenged and partially undermined the view sung in epic.

But the whole picture is complex and not internally consistent. Side by side, from archaic through classical periods, the sacrifice and prayer continued in the sanctuary while the construction of rigorous proofs and investigations into nature continued in the newly emerging agora. In the background, religious institutions conservatively sought to maintain traditions and protocol. The newly emerging foreground, however, offered changes in different directions: on the one hand, various social reforms such as those by Solon and Cleisthenes, responding to the growing wealth of the middle classes, innovatively redivided the populace and introduced more people than ever into the assemblies by extending democratic practices; and on the other, the emerging philosophers inquired into all things and promoted both reason and freedom . . . but only by means of the slavery that provided the leisure for their reflections. While traditional religion and aristocratic privilege persisted, new visions of human nature and the democratic and egalitarian reforms flourished. This new narrative contributes to the more familiar accounts by emphasizing that philosophy is a cultural practice, enmeshed in a society, sometimes undergoing radical transitions and developing contemporaneously along with other practices that seemed squarely at odds with it.

In this long view, Anaximander's vision stands at the dawn of philosophy's new enterprise; he testifies in prose that nature has a highly ordered structure, the details of which can be discovered and commanded by mortals. Sharing a community of interests, Anaximander's book joined the prose treatises by the architects; but curiously enough, they celebrated their visions of nature's order and the human capacity to discover it at the very temple sites—the institutions of *mystification*—that at once reminded men that they could not know, that mortal wisdom was next to worthless. Side by side, what seem contradictory and incompatible unfolded together. Woven in this complex narrative, a new aspect of the origins of Greek philosophy comes to light thanks to the contributions of the ancient architects. Seen from this view, the Greek philosophy that emphasizes rational explanation and the optimism of reason emerges in the person of Anaximander as an unforeseen and unanticipated consequence of an aristocratic effort—the patronizing of the monumental temples in Ionia—to bolster a failing authority. That effort, like the creation of the hoplite, ironically undermined the very ethos that motivated its creation in the first place. The result was a further erosion and diminution of aristocratic authority along with enhancement of *isonomia*, participatory democracy, and despite the undemocratic and unegalitarian sentiments of both Plato and Aristotle, the rational and optimistic Greek philosophy that comprises the focus of first-tier accounts.

# *Notes*

## Chapter One
## Anaximander and the Origins of Greek Philosophy

1. For a recent example, cf. McKirahan 1998, who argued that our list of philosophers might better start with Heraclitus because the large share of what we know of Anaximander, and the Milesians, is now the work, not of "philosophers" but rather, of physicists, astronomers, engineers, and natural scientists.

2. Burnet 1914, p.8.

3. Heath 1921, I, p. 6.

4. Frankel 1962/1973, p. 255.

5. Cornford 1952.

6. Vernant 1962.

7. Burkert 1963.

8. West 1971.

9. Lloyd 1979, 1986, 1990, 1992, 1996.

10. Cf. Guthrie 1962, pp. 34–38, for example, who emphasized the hiatus that resulted following Homer and Hesiod from the rejection of mythological and anthropomorphic explanations along with the emergence of a new kind of causal questioning, especially about the *genesis* of things, that led further to the demand for generalization. The demanded generalization rejected mythologies and in a phrase consisted in *logon didonai*, in giving an account.

11. Cornford 1952, pp. 249ff.

12. Vernant 1962/1983 pp. 345ff; cf. also Vidal-Naquet 1986, pp. 253ff, and most recently Naddaf 1998. The earlier work by Thomson

1955, II., pp. 140–172 also deserves mention since his work was more central in stimulating Vernant than the work of Cornford.

13. Burkert 1963, pp. 97–134.

14. West 1971, pp. 97ff.

15. Two important works by Lloyd, 1966 and 1970, offer learned studies, but he has significantly changed his position on Anaximander and the Milesians since those works. In Lloyd 1970, he also rejected the theory of the "Greek Miracle" (p. 12). When he framed the discussion of explananda for the Milesians, he focused on (1) the rejection of supernatural explanations of natural phenomena, and (2) the institution of the practice of rational criticism and debate in that context (p. 13). Had the Milesians produced a fully articulated system of knowledge, Lloyd asserted, we should then have been right in considering a Greek miracle. Thus, in 1970, the Milesians had a place at the table of *philosophers*; "gradual transitions" seemed to establish the context of tradition and transition that he would later find question-begging. But, in 1970 he also drew attention to economic and political factors that informed the background, a position he would continue to champion and refine. In 1970, while accepting that *"Miletus produced the first philosophers*" (p. 14, my italics), Lloyd was struggling to explain why, and suggested that given the present state of our knowledge, no adequate answer would be forthcoming. But Lloyd did not deny that the Milesians should be regarded as "philosophers"; he offered reasons why (that could only amount to viewing them within the framework of "gradual transitions" that led progressively to those like Plato and Aristotle), and he claimed further that the essence of the Milesian contribution to philosophy was to be found in their introduction of a new critical spirit into man's attitude toward nature . . . a counterpart, and offshoot, of the contemporary development and practice of free debate and open discussion in the context of politics and law (p. 15). Part of my defense of Anaximander is to embrace the kinds of things that also persuaded Lloyd 1970.

16. Lloyd 1979, p. 230.

17. Lloyd 1979, pp. 232–233.

18. Lloyd 1979, p. 236; Aristotle's hypothesis, *Metaphysics A*, 981b17ff. Cf. also Aristotle's discussion of the importance of economic factors in *Politics* 1292b25ff, 1293a1ff, 1320a17ff.

19. Lloyd 1979, pp. 238–239. This thesis has been defended by both Sarton 1953, pp. 160–177, and Singer 1956, neither of whom Lloyd mentions in this context. Cf. also van der Waerden 1961.

20. Lloyd 1979, pp. 236–240. Lloyd follows the lead of Goody in terms of the development of "an accumulation of skepticism" facilitated by writing and the literacy it presupposes. Tablets and lists help provoke certain kinds of questions, especially ones concerning classification. Cf. J. Goody and I. P. Watt 1968, pp. 27–68.

21. Lloyd 1979, p. 235. Lloyd identifies the primary proponent as Farrington 1953. But, cf. also the Marxist thesis on technology defended by Thomson 1955.

22. Lloyd 1979, pp. 240–264.

23. Gernet 1918/1981, pp. 352–364.

24. Vernant 1962/1982, pp. 285ff.

25. Vidal-Naquet 1967, pp. 51–58.

26. Detienne 1967, pp. 99ff.

27. Vlastos 1947, pp. 156–159.

28. Lloyd 1979, p. 248.

29. Lloyd 1979, p. 258.

30. Lloyd 1979, p. 248. That the spheres of law and justice provide important models of cosmic order has been defended for a long time. Cf. R. Hirzel 1907; H. Gomperz 1943, pp. 161–176; L. Gernet 1955; G. Vlastos 1947, pp. 156–178, and again, 1975, among other sources. Cf. also Hussey 1972, pp. 14–15.

31. It seems clear that Lloyd regarded these kinds of criticisms as missing the point. Since he was no longer prepared to accept the conventional reading of the Milesians as "philosophers," and since the secure evidence, in his estimation, was unavailable, the focus on the political conditions in sixth century Miletus merely begged the question.

32. Herodotus 1.12–23, makes this abundantly clear. Thrasyboulos was tyrant in Miletus at the time of the war against Alyattes of Lydia. The tyrants Thoas and Damasenor should probably be dated after Thrasyboulos; their fall was followed by the civil war (cf. Plutarch, *Quaestiones Graecae*, 32). Herodotus 5.29, mentions two generations of stasis before Miletus rose to take the lead in Ionia at the end of the sixth century. Cf. also Humphreys 1978, p. 302n24.

33. Hurwit p. 205. Cf. also Emlyn-Jones 1980, ch.2.

34. Herodotus 5.92; cf. also 1.23. Herodotus describes the advice coming from Thrasyboulos to Periander. Aristotle, curiously enough, in the *Politics* 1284a and 1311a describes it the other way around. The important point is the communication between tyrants that displays an agreement on such strategies.

35. Herodotus 1.12–18.

36. Athenaios, *Deipnosophistae* XII.524a. Cf. also the discussion in Hurwit 1985, pp. 203–206; Humphreys 1978, pp. 221–222.

37. This point is central to the objections offered by both Frischer and Hurwit. Frischer 1982, pp. 11–16, esp. 15, points out that philosophy seemed to flourish first in cities that lacked participatory forms of government. Cf. also Hurwit 1985, p. 204.

38. Cf. DK 12B1, the fragment preserved by Simplicius. Indeed, cf. also Naddaf *JHI* 1998, who argues that Anaximander's cosmology is driven by Utopian concerns.

39. Frischer 1982, p. 15.

40. Frischer 1982, p. 16.

41. Hurwit 1985, pp. 203–205.

42. Hurwit 1985, p. 205.

43. Herodotus 1.17; cf. also Guthrie 1962, pp. 32ff.

44. Cf. Schneider 1996. The usual dating suggested by Gruben 1963; Bammer 1984; and Akurgal 1985 has now been contested.

45. Lloyd 1986, knows of Frischer's work.

46. Lloyd 1986, pp. 74–75. He regards rigorous proof to be confined to Greece.

47. Lloyd 1986, p. 78; cf. also note 105 where he aligns himself with Vernant 1962/1982, Vidal-Naquet 1967/1986, and Detienne 1967, and his own work 1979, ch. 4. Cf. also, pp. 72–73. While he explicitly rejects the "Greek Miracle," he once again revisits the work of Goody and Watt and echoes a very similar sentiment to the one expressed in the 1979 work, namely, that literacy permits a different kind of critical inspection, more leisurely and formalized, in the effort to identify contributing factors. "It permits (though it does not dictate) critical scrutiny, may highlight (by recording) innovation, and may also affect cognitive processes." But he immediately criticized the point as insufficient.

48. In the 1986 work, in the conclusion to chapter 2, he emphasized two issues: the overtness of innovation and the contestability of tradition. The presentation suggested a new balance was being sought for, and a different emphasis was being placed upon, likely contributing factors. In the 1979 work he acknowledged the hypotheses of Aristotle's leisure, the intermingling of beliefs, literacy, and technology, to play some arguably contributing role. He emphasized the importance of the "polis," that is the political dimensions, in order to

explain, over and above these other hypotheses which have all had defenders, why speculative thought developed in Greece and not the other Near-Eastern and Mesopotamian civilizations that all possessed the other four ingredients in varying degrees. In the 1986 revisit, he did not mention the hypotheses of leisure, intermingling of beliefs, or technology, but this should come as no surprise since he had already dismissed them as insufficient in the 1979 work. Lloyd did grant a special emphasis to politics, and reasserted the central importance of rigorous proof, as opposed to mere confirmation or checking out a result. Furthermore, he saw the dynamic interplay of factors to juxtapose innovation and tradition.

49. Lloyd 1990, pp. 59ff.

50. Lloyd 1990, p. 60.

51. Lloyd 1990, p. 61. The same point of departure was embraced by McKirahan 1998.

52. He emphasized just this point next by insisting that if we regard Cleisthenes as establishing the full democracy, Solon must be recognized as the one who *initiated* democracy in 594, and he refers to Aristotle's (?) *Constitution of Athens* to shore up his position on this matter. Then, he reminded the reader that even if Cleisthenes was more democratic than Solon, Solon's democratic ideology already contains: (1) the importance of the access of all citizens to justice; (2) a certain policy of openness, manifest in his promulgating his reforms publicly and in explicitly justifying them in the poems that have come down to us; (3) the possibility of radical constitutional change. In the "General Conclusion" he asserted: "*[B]oth* philosophy and science are gradual developments (where the most important work was done in the fifth and fourth centuries) *and* that democracy itself *also* was" (p. 61). Again, Lloyd's explicit statements further support the classification of his approach as first tier; Thales and Anaximander are allowed into the discussion only insofar as they contribute to the story that is characterized by second-order questions and rigorous proof, though there is insufficient evidence to make the case for the Milesians themselves.

53. A sentiment that pervades the 1979 thesis finds expression in the phrase that "Greek rationality is the product of the polis." Lloyd calls upon the phrase when referring to views of Vernant, Vidal-Naquet, and others; while it was their phrase, Lloyd seems to have had a greater sympathy for such a view then than he did as time went by. Such expressions were no longer endorsed in his writings and this seems to be because terms such as *product* were withdrawn in the

absence of the compelling causal argument. Lloyd 1979, p. 248n.98: "The theme that *Greek rationality in general is the product of the city-state* has been developed forcefully in the works of Gernet 1917 (and 1955) 1968, Vernant (1957), 1965, pp. 285ff, and 1962, Vidal-Naquet 1967, and Detienne 1967, pp. 99ff. *What follows is much indebted to these studies*" (my italics). I am grateful to Professor Lloyd for his valuable comments, made in correspondences, on this chapter, clarifying his positions on this and other matters.

54. Lloyd 1990, p. 64, italics added.

55. In the 1979 work, the two characteristics that mark "philosophy/science" were expressed as (1) rigorous proof, and (2) second-order questions. He repeated the importance of second-order questions in chapter 2 of this 1990 work, and then chapter 3 of the 1990 work is devoted entirely to the conception and practice of proof. In his conclusion to chapter 3 he contrasted and blended chapter 2, which emphasized the extensive experience that many Greeks had evaluating arguments in the law courts and assemblies, with ideals of proof. Here, in chapter 3, "proof" advances the argument further of both the direct and indirect background. First Lloyd says, "We can hardly doubt that the political and legal domains provided and continued to provide the primary sphere of application of those [informal and formal proof] notions. It is from those domains, principally, that the terminology of evidence, witnessing, scrutiny and proof beyond a reasonable doubt comes . . . ," and then shortly thereafter, "that political and legal experience may also be relevant indirectly to the development of formal and rigorous proofs as well" (the case of Hippocrates of Chios is highlighted, pp. 96ff). And again he echoed the sentiment of the 1979 work, now in 1990, when he maintained—a first-tier approach—"But certainly by the time we come to Plato, the contrast between merely persuasive and proof is drawn in the sharpest terms and the latter used as one powerful way to mark-off Plato's own conception of philosophy from the work of the sophists in particular and from rhetoric in general . . . ["proof" for Plato] secure[d] the truth and gave a rational account of it" (p. 96).

56. Lloyd 1990, p. 97.

57. Lloyd 1992, p. 43.

58. Lloyd 1992, p. 44.

59. Lloyd 1992, p. 52.

60. Lloyd 1992, p. 53, emphasis added.

61. Lloyd 1992, p. 53.

62. Lloyd 1992, p. 54. Judging by the 1992 piece, most of the 1990 themes remain largely the same. Cautious not to assert causal claims one way or the other, Lloyd prefers to note parallels, to suggest the likelihood of influence and affect, but stops short of insisting upon a definitive causal argument. Like the 1986 work, the agonistic spirit of Greek society is reaffirmed, techniques of persuasion/proof are highlighted, and Lloyd again showed himself to be a first-tier proponent. Lloyd continued to focus on the characteristics that are displayed in Plato and Aristotle; his narratives explored individuals and cultural practices that might foreshadow or promote them. If philosophical openness is to be largely accounted for by an appeal to the developing epistemologies, such an analysis still will not explain how Anaximander and the Milesians got started. However, by emphasizing the role of "reason" in Plato and Aristotle, he provides the grounds for including Anaximander, and perhaps might have revised his assessment had he embraced more closely some of the focus of second-tier approaches. Having not done so, Lloyd's 1992 work moved progressively away from focusing on the question of how Thales and Anaximander got going "philosophically." He can avoid this question to some degree by declining to include them as philosophers proper—though he acknowledges that the ancient tradition regarded them, indeed called them, as such—since they might well not meet the criteria of second-order questions and rigorous proof. But, since they played some contributing role toward the exaltation of "reason"—advancing rational explanations while abandoning supernatural explanations—they might be appropriately included.

63. Cf. Lloyd 1979, pp. 252ff; and reaffirmed explicitly in Lloyd 1986, p. 80n109.

64. Lloyd 1996, p. 5.

65. Lloyd 1996, pp. 101, 141, 174, 177. I am grateful for discussions with Bill Eaton about these passages.

66. Lloyd 1996, p. 4.

67. Lloyd 1996, p. 49.

68. This kind of approach is strikingly suggestive of Colin Renfrew's "multiplier effect."

69. Cf. Naddaf *JHI* 1998, who argues that Anaximander had a utopian conception.

70. Cf. chapter 4, below.

71. Lloyd 1996, pp. 174 and 177.

72. Lloyd 1970, pp. 134–135, where he mentions early architectural treatises is one of the rare occasions on which he even mentions architecture. The entry "architecture" does not appear in the index of the 1979, 1986, 1990, 1992, or 1996 works. Nor does it appear in the 1983 or 1991 works.

73. Championed in different forms and by different arguments by James 1954; ben-Jochanan 1971; Diop 1974 and 1986. In a distinct argument tracing the indebtedness of Bronze Age Greece to Egyptian influence, cf. Bernal 1987.

74. Lefkowitz 1996; and with G. M. Rogers 1996, the response to Bernal. Cf. also Naddaf's review of Lefkowitz 1998.

75. For general discussions of ancient technology, cf. K. D. White 1984, Brumbaugh 1966; for architectural technologies, Orlandos 1966, and Coulton 1977.

76. Cf. Lloyd 1990, *Demystifying Mentalities*.

## Chapter Two
## The Ionian Philosophers and Architects

1. The assignment of the date is not controversial since many commentators have accepted a date circa 550 BCE. Nor is the argument for establishing that date an issue of contention. According to the tradition traced through Apollodorus, Anaximander's book appeared one year before the conquest of Sardis by Cyrus. What is important, however, is the historical context in which the literary event is set.

2. Burkert 1985, p. 310; Diogenes Laertius, 9.6.

3. Cf. Schneider 1996. Until the recent excavations, the usual view placed the early stages of building the archaic Didymaion as roughly contemporaneous with the building of the archaic Artemision. Cf. Gruben 1963, pp. 87 and 89; Akurgal 1985, p. 223: "[W]e come to the conclusion that a great part of the archaic Didymaion was completed by 560–550 BC at the latest." That date has now been contested.

4. Akurgal 1985, p. 148; Bammer 1984, pp. 183, 259; Gruben 1963, p. 89.

5. DK 12A7.

6. DK 12A11. But even Hippolytus *(Refutations* 1,6,7 = DK12A7) seems to be off by one year since he gives the birth year as Olympiad 42,3 instead of Olympiad 42,2. Cf. Kirk-Raven 1957, p. 100n1.

7. DK 12A5 (*Nat. Hist.* II, 31). The determination of the obliquity of the ecliptic requires an idea of terrestrial latitude and this he cannot have conceived since the earth for Anaximander is a flat cylinder not a sphere. But, he might likely be supposed to adumbrate our concept of the obliquity of the ecliptic, as Sarton noted:

> Indeed, he could observe that the sun moved each day in a plane and described a semicircle from east to west culminating in the meridian at noon; the inclination of that plane to the horizon varied from day to day, being smallest at the winter solstice (when the noon shadow of the gnomon was shortest) and largest at the summer solstice (when the noon shadow was longest); the plane reached its half-way position at the times of the equinoxes (when the sun rose due east and set due west). The angle between the two extreme positions of the solar plane (ecliptic) is twice as large as the one we call the obliquity of the ecliptic. Anaximander could possibly have measured the angle, but it would be highly misleading . . . [to say] that he discovered the obliquity of the ecliptic (that is, the angle between the ecliptic and the equator) because he could not conceive the equator any more than the latitude.

8. On the authority of Eudemus, Oinopides first discovered the obliquity of the ecliptic (DK 41A7). For Oinopides, cf. Heath 1959, pp. 21, 130–131, 319; Guthrie 1962, ii. p. 360, who claims Oinopides first *measured* the obliquity; Kirk-Raven 1957, p. 103n; and the cautions offered by Dicks 1970, p. 157.

9. Burnet 1945, p. 13.

10. Kirk-Raven 1957, p. 100n1.

11. DK 21B22.

12. Burnet 1945, p. 51.

13. DK 12A9 and 12A15; cf. also Kirk-Raven 1957, p. 101.

14. For the most complete listing of translations of the fragment, cf. Couprie, 1989, Appendix I, pp. 192–211.

15. A point emphasized by many scholars. Burkert 1985, p. 305: "Philosophy indeed begins with the first prose book." Humphreys 1978, p. 223: "The fact that the first philosophical books were prose works suggest rejection of the conventions. . . ."

16. Cf. West 1971, pp. 4–7. In order for the title to have been *peri phuseos* the word *phusis* would have to have a meaning for which there is no evidence until the fifth century. In West's estimation, this suggests at least two points: (1) it is unlikely that Anaximander's book was known by this title, and (2) perhaps the book had no title at all. The

addition of the words *tōn apantōn*, West noted, would have made the expression intelligible to a sixth century audience.

17. West 1971, pp. 5–6, and 76–77.

18. OCD, p. 812; Jaeger 1947, pp. 66ff; Vlastos 1952.

19. Cf. Schibili 1990, pp. 128–134.

20. West 1971, p. 24.

21. DK 7B1. Cf. also Kahn 1960, p. 240, Schibili 1990, p. 128, and 135ff.

22. DK 7B2, *e hupopteros drus*.

23. DK 7A11, *to dendron*.

24. Cf. Freeman 1959, p. 40.

25. West 1971, p. 27.

26. West 1971, pp. 55ff.

27. Homer, *Iliad*, 14. 202ff, and below, ch. 4.

28. West 1971, pp. 19 and 49.

29. Gagarin 1986.

30. Gagarin 1986, pp. 145–146.

31. Gagarin 1986, p. 121.

32. Havelock 1878, pp. 137ff; cf. Gagarin 1986, p. 98.

33. Gagarin 1986, p. 125; Cf. also Herodotus 1.59, and Thucydides 6.54. For example, one of the earliest lawgivers, Pittacus of Mytilene was himself a tyrant, and the existence of written laws did not prevent Pisistratus's tyranny soon after Solon's decrees. Although these legal reforms may indeed have later increased the power of the people, the initial result seems to have been to strengthen the control of whatever group governed the cities, and that meant the aristocracies.

34. Gagarin 1986, p. 126; Cf. also Willets 1967, p. 9; also repeated in 1982, pp. 234–248, esp. p. 240. Only very few of Solon's laws concern trade, and the fact that there appears to be contemporaneous development of trade, coinage, and written law—both Gagarin and Willets argue—is not sufficient to argue for causal connection.

35. Gagarin 1986, pp. 126–127; Cf. also Muhl 1933, ch. 3, in which striking parallels between some laws in these two domains are present. Gagarin notes the parallel but dismisses the claim of direct connection.

36. Gagarin 1986, pp. 129–130. Gagarin attributes this hypothesis to Bonner and Smith 1930. He also notes the exceptional case of Thurii, a panhellenic colony (c. 443 BCE) whose written laws were supplied by Protagoras.

37. Gagarin 1986, p. 137ff. Cf. also Glotz 1926.

38. Snodgrass 1980, ch.2, discussed in detail in chapter 5 below; Gagarin 1986, p. 140.

39. N.B. Simplicius observes that the parlance is poetical.

40. This sort of reading is in line with the Utopian interpretation of Naddaf 1998 *JHI.*

41. Xenophon, *Memorabilia* 4,2.8–10; Cf. also Coulton 1977, p. 25.

42. Vitruvius VII, 12 (p. 198). The name of an architect Paconius is identified with the temple of Apollo at Didyma, X,2,13 but this name is connected with the Hellenistic reconstruction and not the archaic temple, for which the name of the architect has vanished.

43. The tradition that the sixth-century BCE architects wrote treatises rests on the authority of Vitruvius who especially praises the ancients who, as he puts it in the opening to book VII.1 (p. 195), "transmit their thoughts to posterity by recording them in treatises. . . ." Since none of these early treatises survives, there has been some reluctance to accept Vitruvius's word. Holloway 1969, p. 286, doubts it: "[O]ne does not expect technical treatises in the early sixth century." There is, however, no good reason to reject Vitruvius's statement, and it is the intention of this book to provide further reasons for accepting it. Coulton 1977, p. 24, seems to accept it without hesitation: "An important development in the middle of the sixth century was the writing of the first architectural treatises. . . . These must have been among the earliest prose works in Greek, for the first philosophical work in prose was written by Anaximandros of Miletus at just about the same time. The Ionian school of philosophy in the sixth century had an interest in the practical as well as the abstract. . . . It is presumably not merely coincidental, therefore, that the first Greeks to write about architecture were working in Ionian cities." Hurwit 1985, p. 210 is just as unhesitant: "Rhoikos and Theodorus wrote a book about the limestone behemoth—another example of early prose and one probably far more prosaic than Anaximander's book on nature . . . [sc. concerning the Artemision]. Chersiphron of Knossos and his son Metagenes, wrote a book about their temple, too." Cf. also the magisterial work by Dinsmoor, 1902/1950, p. 124n1: "The book by Theodorus (the earliest architectural treatise of which the title has come down to us). . . ." Tomlinson 1976, p. 127: "The architects of the temple were Rhoikos and Theodorus. Theodorus wrote a treatise about it which was known to the Roman architect Vitruvius."

44. Let me say a few words to any who might question the appropriateness of this parlance. Geometry, of course, originally and literally meant the measurement of the earth. It found a natural application to the effort to re-draw land boundaries after the Nile flood. Thus, practical applications are the circumstances in which the abstract enterprise has its roots. In the ancient world, a wide range of activities were not classified according to our contemporary predilections, just as ancient disciplines of study do not always closely resemble the disciplinary matrix of our modern universities. The work of the ancient architects, as we shall see, included a very wide range of activities usually not associated with the work of modern architects. Certainly architectural planning and design were included in their functions, but architects such as Theodorus and Rhoikos (though it is often hard to tell precisely who did what) were responsible for the production of architectural paradigms such as column-drums, capitals, architraves, and so on—as we know from the studies by Boersma 1970 and Burford 1969 on architectural activities in the fifth and fourth centuries and from the detailed discussion by Coulton 1977. But the tertiary testimonies on the archaic architects show us that they were also involved with the casting of life-size statues out of bronze (and thus rivalled the sculptors—N.B. this technique required that they were master potters since the molds were made of clay), the inventors or modifiers of building tools and techniques, inventors of vehicles of transport, perhaps also the engravers of gems and the makers of miniature sculptures (Pliny tells us the remarkable story that Theodorus could not only make life-size sculptures but also tiny models such as a charloteer whose chariot is being pulled by four horses, that was so tiny that it could be hidden behind the wing of a fly!). Seen in this light, various achievements, such as the diversion of the Imbrasus river by Theodorus in order to set the platform for the Heraion are related feats of *technē*. In this case it is specifically what we would now compartmentalize as a feat of engineering and shows us the extraordinary range of skills and activities that were exhibited by archaic architects. "Engineering"—of course a modern term—entailed activities that included the quarrying, transporting, hoisting, levering, pulleying, and so on of the megalithic masonry; sometimes scholars have sought to distinguish Rhoikos as "architect" from Theodorus as "engineer" but this is a very difficult case to make although I present Holloway's thoughtful conjecture in the long footnote later in this chapter. As a team, Theodorus/Rhoikos, according to Holloway, handled the vast array of problems for their enormous construction, including the

orchestration of the substantially sized work force. The diversion of the Imbrasus deserves to be seen alongside the claim of Thales' diversion of the Halys, and both relied on engineering skills that, in the ancient world, were part of the applications of those land/water measurement (i.e., geometric) enterprises. Finally, the main point is to consider the kinds of achievements with which Thales/Anaximander and Theodorus/Rhoikos and Chersiphron/Metagenes were credited to note the broad family resemblance. When the family resemblance is identified with "applied geometry," it is important to recall that the Greek tradition of "geometry" traces its lineage no earlier than Thales, and what this means is that a wide range of practical problems sought solutions and the kind of geometrical theorems and geometrical applications with which Thales is credited cannot be pigeonholed within the classificatory rubric of *our* disciplinary matrix without distorting what his achievements and reflections meant to his archaic community. "Applied geometry" is an appropriate way to describe the broad family resemblance, and diverting a river, for example, is part and parcel of this family.

45. Herodotus 1.74; cf. also DK 11A5. In the war between the Lydians, led by Alyattes, and the Medes, led by Cyaxares: "When the war had dragged on indecisively into its sixth year, an encounter took place at which it happened that the day suddenly became night (*hōste tēs maxēs sunesteōsēs tēn hēmerēn exapinēs nukta genesthai*). This is the loss of daylight that Thales of Miletus predicted to the Ionians, fixing as its term the year in which it actually took place." It has been recognized for some time now that Thales could not have successfully predicted a solar eclipse (though he might have said that one was likely within a small frame of time) even with a knowledge of the *saros*, the cycle of 223 lunar months (18 years, 10 days, and 8 hours) after which both lunar and solar eclipses are likely to occur. Van der Waerden 1961, pp. 86–87, dismissed the *saros* hypothesis as mere fairy tale but suggests that Thales might have made such a prediction based upon the Babylonian theory that 51 draconitic lunar periods = 47 synodic months. "According to this relation, the possibility for the repetition of a lunar eclipse exists 47 months after a total lunar eclipse, while the chance of a solar eclipse occurs 23 1/2 months after a total lunar eclipse. Indeed, a considerable lunar eclipse could be seen 23 1/2 months before the eclipse of Thales." Regardless of the technical stance that one adopts on Thales' alleged prediction, it is significant that a tradition not much more than a century old credited him with such astronomical accomplishments,

not only by including him on every list of the "Seven Wise Men" but also cf. Aristophanes' *Birds* 995ff, 1009. For the more serious reservations, cf. Dicks 1970, p. 43, and p. 225n45.

46. The measurement of the height of a pyramid by the measurement of its shadow is reported by D.L. I, 27; Pliny 36.82; Plutarch 147a; cf. DK 11A21. Cf. also Burnet 1945, pp. 45ff.

47. Cf. Bridges 1996, p. 20.

48. DK 11A20, on the authority of Eudemus, related by Proclus in his work on Euclid (352.14). In that passage it is suggested that Thales' success in determining the distance of a ship at sea was a consequence of his application of a theorem that he allegedly perfected: "A triangle is determined if its base and the angles relative to the base are given."

49. This testimony comes from Callimachus; cf. Guthrie 1962, p. 51.

50. DK 11A6. Cf. M. Greene 1992, pp. 89–105 for his conjectural reconstruction of the technique.

51. Herodotus 1.75. It is quite ironic that Herodotus, who tends to believe anything that anyone has ever told him, singles out this event as subject for disbelief. The evidence suggests, however, that the bridges were not built until the time of Darius c. 520 BCE as part of the Royal road of the Persian Empire that ran from Sardis to Susa. Cf. Greene 1992, p. 96.

52. D.L. 1.22. the date of 582/1 is arrived at from the assertion that the title was bestowed during the archonship of Damasias at Athens.

53. DK 11A11.

54. DK 11A11, on the authority of Proclus.

55. DK 11A11, on the authority of Proclus.

56. DK 11A11, on the authority of Proclus. But, on the authority of Eudemus, only the discovery is attributed to Thales while the proof is credited to Euclid.

57. D.L. 1.24, on the authority of Pamphilia, a compiler of the first century ACE.

58. Dicks 1959, pp. 294–309.

59. Kahn 1970. I am also most grateful to Dirk Couprie whose thoughtful reflections on Thales in a series of correspondences have guided my response to Dicks's extreme reservations.

60. Cf. Roller 1978, p. 251, where he identifies an inscription that names a "Thales" as dedicator of the statues that lined the Sacred Way from Miletus to Didyma; there and again in 1989, p. 187, he conjec-

tures that perhaps this building project was financed in part by Thales and Anaximander. If so, then Thales' reflections on levelling devices, and perhaps other aspects of the monumental building programs, was not the effort of a disinterested party.

61. von Fritz 1971, pp. 401ff. The term he uses is *Aufeinanderpassen*.

62. Heath 1908, I, p. 225; Common-Notion #4 is discussed on pp. 224ff.

63. Heath 1908, I, p. 225. Heath also goes on to say that the method was not of subordinate importance but rather was fundamental, but Euclid nevertheless disliked it and avoided it if and when he could.

64. Rankin 1961, pp. 73–76.

65. Schmidt 1886, IV, p. 475: "*homoios* bedeutet gleich an Beschaffenheit," for *isos*, pp. 472 and 474.

66. Cf. Guthrie 1962, vol. I, p. 53; also Proclus (Friedlein), p. 188, also 157.

67. Cf. Heath 1908, I, p. 185, quoting Proclus: "[I]f it is desired to prove it mathematically, it is only necessary to imagine the diameter drawn and one part of the circle applied to the other; it is then clear that they must *coincide*, for if they did not, and one fell inside or outside the other, the straight lines from the centre to the circumference would not all be equal: which is absurd."

68. von Fritz 1971, pp. 401ff.

69. Coulton 1977, p. 55.

70. The gnomon is probably synonymous with the seasonal sundial rather than the more familiarly used "vertical rod." Cf. Gibbs 1976, pp. 6–7.

71. By drawing up these lists, other alleged achievements are omitted. Thales is credited with offering practical political advice advocating the federation of the Ionic cities in the face of the Persian threat, and business cleverness in buying out the olive presses following a meteorological prediction of a bumper crop and then renting out the presses at considerable profit following the enormous harvest. Anaximander is credited with founding the colony of Apollonia and offering an evolutionary model of human origins and development. No doubt, these *phusiologoi* were practical geniuses. The main point of the lists constructed here is that the broad family resemblance of achievements is indeed applied geometry.

72. The identity and occupation of "Theodorus" has been discussed in a particularly illuminating way by Holloway 1969, pp. 281–290. The

argument he offers is plausible but uncertain. He wants to distinguish two different persons with the name "Theodorus" and their respective activities. He may indeed be correct, but my argument is not substantially affected either way. Even if these two persons with the name "Theodorus" belong to successive generations, the family resemblance of their activities still makes the general case for the kinds of enterprise contemporaneous with that of Anaximander.

Holloway believes there is a distinction to be made between "Theodorus," son of Rhoikos, who is properly the "engineer," and "Theodorus," son of Telekles, who is an architect. Holloway concludes that (p. 287) "Rhoikos, the sculptor and bronze worker, was what we would call the architectural designer and that Theodorus [sc. his son] was the consulting engineer." It was this same Theodorus who was called to Ephesus to assist the architect Chersiphron with the Artemision; he advised the placing of sheepskins and charcoal under the foundation in order to stabilize it in the marshy soil. And it was the same Theodorus who built the *skias*, a round shaped umbrella-like hall at Athens (Pausanias 3.12.10).

In Holloway's estimation the work of the ancient "architect," in general, was unlike that of the modern architect (p. 289): "[T]he architect of the classical world seems to have submitted only a *syngraphē* or statement of specifications and full-scale models of individual details. . . . The use of full-scale models rather than a drawing emphasized the work of the sculptor-designer in the creation of monumental stone building. . . . Once the *syngraphē* was approved and the models prepared, the architectural designer's job was done." These skills, Holloway believes, can be distinguished from the technical knowledge of the early Ionian engineers, a role developed from the general skills of the building trade. Consequently (p. 289), "[T]he supervising engineer's position was reduced to that of a job foreman, paid at the rate of a skilled workman, as we find in the building accounts of the Erechtheion [cf. *IG* I.2, 374, lines 256–258; and in general, M. L. Clarke 1963, pp. 9–22].

73. Cf. the discussion by Lippold in *RE.* Cf. also OCD, p. 1055, "He was said to have invented the line, rule, lathe, and lever. . . ." The testimony comes from several sources: Herodotus 1.51, 3.41, 3.60; Plato, *Ion*, 533b; Vitruvius VII, introd. pp. 195–201, esp. pp. 198, 200; Pliny 7.56, 198.34–83 (this list also includes the clavis, which is some sort of wrench), 35–146, 152, and 36.19.90; Pausanius, 3.12.10, 9.41.1; Diodorus Sicilus 1.98.5–9, Cf. Farrington 1949, p. 81 whose list includes "the level, the square, the lathe, the rule, the key. . . ." Cf. also

H. Johannes 1937, pp. 15–17 for the confirmation that the column-drums from the Dipteros I temple were turned on a lathe. For some consideration of Rhoikos, cf. Holloway 1969, p. 287; Boardman 1980, pp. 131–132, 144; Kyrieleis 1981, pp. 73–81; Hurwit 1985, pp, 184, 196, 210; Grant 1987, pp. 152ff, 155, 344.

74. Pliny, 36.95, notes that 150 columns were included and that the column-drums were so well hung in the workshop that even a child could turn them on the lathe. Pliny identifies the temple variously as the "Labyrinth" and as the "Lemnos"; Dinsmoor 1902/1950, p. 124n1 offers the explanation that Pliny misinterpreted *en-limanais*, that is, "in the marshes" for the distinct name "Lemnos." It is important to note that the construction takes place in the marshy soil sacred to Hera. Eilmann 1931, p. 84ff, and Holloway 1969, p. 287, both conclude that it is the Samian Heraion that seems to be at the bottom of Pliny's account.

75. This must be inferred on the grounds that in order to set the platform for the monumental temple credited to him—Dipteros I—the river had to be diverted. This is precisely the reason supplied by Tomlinson 1976, p. 125. Cf. also Cook 1982, p. 204.

76. West 1971, p. 5.

77. West 1971, p. 5. The citations include the *Hymn to Apollo*, Heraclitus, in D.L. 9,6, and Pindar's *Seventh Olympian*.

78. Cf. Hermann Kienast 1995. Dr. Kienast shared with me his opinion that, while Eupalinos may have been born in Megara, he must have lived for a considerable amount of time on Samos. This is because the tunnel construction proves to be the work of a highly skilled surveyor who had to have had long and intimate knowledge of the topography in order to succeed in his project, and the evidence shows his success.

79. Snodgrass 1980, p. 21; Coldstream 1977, ch.2; Desborough 1972 p. 188–189; Vernant 1962/1982, pp. 38–48. Concerning burial practices and their transformations with the rising population in the early archaic period, cf. Hagg 1983, pp. 27–31; Sourvinou-Inwood 1983, pp. 33–48.

80. Snodgrass 1980, pp. 42–44, 46, and also 24; Sourvinou-Inwood 1983, pp. 34–36.

81. Snodgrass 1980, pp. 19–20; Boardman 1980, pp. 111–161.

82. We will follow through on this line of thought in chapter 5, below.

83. Snodgrass 1980, pp. 22–23; Haag 1983, pp. 27–29.

84. Coulton 1977, p. 30: "Between about 1100 BC and 700 BC there was no truly monumental architecture in Greece." Nor can he find evidence of quarries, p. 45.

85. Tomlinson 1976, p. 125; Grant 1987, p. 153; Coulton 1977, p. 32; Boardman 1980, pp. 110–112; M. Greene 1992, p. 105. Cf. also Herodotus 2.142–154, 4.152ff.

86. Pharaoh Psamtik (c. 640–610 BCE), son of Pharaoh Neco I who ushers in the 26th dynasty, is discussed by Herodotus 2.151–152 who calls him Psammeticos.

87. Herodotus 2.152ff.

88. Pliny 36.95; Herodotus 2.148.

89. Cf. M. Greene 1992, pp. 102ff.

90. Herodotus 2, 161. The Egyptian monuments show that this was a considerable expedition, cf. Gardiner 1961, pp. 359ff.

91. Cf. Boardman 1964/1980, pp. 115–116. The longest Greek inscription rock-cut on the leg of the colossal statue of Ramesses II at Abu Simbel reads: "When King Psammetichos had come to Elephantine, this was written by those who sailed with Psammetichos, son of Theokles, who went as far upstream as they could—above Kerkis. Potasimto led the foreigners and Amasis the Egyptians. This was written by Archon son of Amoibichos and Pelekos son of Eudamos." Included in the other inscriptions are names of men that reveal their home cities from eastern Greece: "Elesibios of Teos, Pabis of Colophon, Telephos from Ialysos in Rhodes."

92. Cf. for the older picture, Lawrence 1957; Robertson 1943 and 1969; Gruben 1963; Bammer 1984; Akurgal 1985.

93. Schaber 1984; Schneider 1996, *DiskAB*.

94. Kienast 1991.

95. For the outlines of the transmission from oriental sources, especially Hittite, cf. Nylander 1970. Snodgrass 1980, p. 53; Cf. also Burkert 1983, p. 118 on the same influx of oriental technology especially connected to the Samian Heraion. For emphasis on the Egyptian connection, cf. also Braun 1982, esp. 55ff.

96. Kienast 1991, p. 123; he claims the building was erected between 575 and 560 BCE.

97. Cf. Burkert 1985, p. 89 for a description of foundation ceremonies.

98. Buschor 1930. Cf. also the comparative illustration in Rykwert 1996, p. 267.

99. The problems of changing from wood to stone architecture are formidable in many ways. Of course, the techniques by which wood architecture was effected were sometimes inapplicable when working stone, and thus a vast array of new techniques would have been required. But, moreover, in the transition from wood to stone architecture, so many refinements had *already* to have been worked out in advance because "adjustments" in stone, whether curving the stylobate or the modifications of entasis, are not feasible when the stones are already in place. Imagining how the techniques were worked out in the seventh century so that the stone projects could even be reasonably entertained at the end of that century and in the beginning of the sixth is a source of great wonder.

100. Kienast 1991, pp. 124–128. Kienast explores the issue of whether or not the ground of the construction site influenced the choice of the site. He concludes that it did not. Moreover, although there was additional support of the foundation for the walls of the cella in Dipteros II (which immediately followed Dipteros I), no additional efforts were made to bolster the support for the peristyle. This study enabled Kienast to conclude that even the improvements in the foundation of the cella walls did not prevent the massive walls from sinking and slipping—not to mention the added difficulties for the columns constituting the peristyle that did not have benefit of additional support. And, hence, the foundation of Dipteros II benefited somewhat by "experience" but not "technological progress."

101. Tomlinson 1976, p. 125: "The position of the east front [sc. of Dipteros] was determined by the site of the altar (which, although rebuilt, was not moved) and the greatly increased length of the new temple was achieved only by diverting the Imbrasos and building in the reclaimed land." That the Imbrasos was diverted seems less controversial than the question of when it was diverted. Kyrieleis 1991, "[D]ie Strasse wurde angelegt im späten 7. Jahrhundert. Hierzu was es notwendig, einen Arm des Flusses Imbrassos . . . umzuleiten. . . ." Borelli 1976, p. 802: "This [i.e., the new temple of the seventh century] was built on the original bed of the river whose course was changed at that time." And Cook 1982, p. 204: "One of the problems confronted was that of marshy ground by the river Imbrasus whose course had to be diverted; this seems to have been the work of the Samian engineer Theodorus. He was also called as a consultant at Ephesus."

102. Aristotle, *Metaphysics*, 983b6ff. For some interesting comments on the landscape surrounding the Heraion, cf. Scully 1962, p. 49ff.

103. Cf. the very interesting conjectures by M. Greene 1992, pp. 89–105.

104. Tomlinson 1976, p. 125.

105. The main structural point to emphasize is that Ionic temples of the sixth century BCE in Samos, Ephesus, and Didyma are roughly twice as long as they are wide, and twice as wide as they are high. That is the overall gestalt. But there is considerable disagreement over the exact measurements, or at least the way that they are presented. Some have given the dimensions in terms of the rectangle formed by the stylobate, while others have given the larger rectangle constituted by the inclusion of the two steps, just below and outside the stylobate. I follow the German excavators here. Kyrieleis 1981, p. 73, following Walter 1976, gives the measurements: 172.2 by 344.4 feet (52.5m × 105m = 100 × 200 Samian ells); Dinsmoor 1902/1950, p. 124 and Tomlinson 1976, p. 125, both give the same measurements: 174 by 314 feet, or 171 by 311 feet depending upon the reference to the steps. Robertson 1969, p. 331: 50.50m × 103m.

106. N.B. I am following the latest reasoning expressed by Hermann Kienast (1999) and his colleagues of the *Deutsches Archäologisches Institut* working in Samos. Herodotus identifies Rhoikos as the architect of the greatest temple ever attempted in Greece. This must be Dipteros II, dating to the second half of the sixth century. Dipteros I, identified as the work of architect Theodorus, is earlier, dating to 575–560.

107. The details of the sacrifice are discussed in extraordinary detail and with exceptional clarity in the selection of articles contained in Detienne and Vernant 1989. The importance of animal sacrifice to the community's distribution of meat should not be underestimated.

108. We shall follow through this line of thought in chapter 5, below.

109. Cf. the comparative chart of the development of the archaic Heraion at Samos, plan view.

110. Cf. Coulton 1977, pp. 32–33. Cf. also Davis 1981, for the transmission of Egyptian techniques to Samos.

111. Cf. Kyrieleis 1981, whose plan commits him to the position of 134 columns.

112. Pliny 36.19.90.

113. Cf. Johannes 1937, pp. 13–37.

114. Cf. Coulton 1977, p. 24: "Although these architectural works are lost, it seems likely that they detailed information about the two

temples preserved in later authors and derived from them. If so, we can be sure that they were not preliminary specifications for the buildings, as sometimes has been argued, for we learn of the problems that arose during the construction. The emphasis seems to have been on the technical problems involved. Theodorus is credited with the invention of the square, the level, and the lathe, and a lathe was indeed used for the bases of the columns at Samos; all three of these devices must have been known before (the first two are obviously essential for monumental architecture in dressed stone) and so Theodorus was probably the first to describe them." Cf. also Wesenberg 1986, pp. 40–41.

115. On the authority of Pliny 36.90; the technique described was to secure the platform by placing sheepskins and ground charcoal under it. The excavators, however, have so far found no evidence to support Pliny's claim. Cf. also Dinsmoor 1902/1950, p. 127; Tomlinson 1976, p. 129; Cook 1982, pp. 204–205; Akurgal 1985, p. 148n52. For some interesting comments on the landscape surrounding the Artemision, cf. Scully 1962, p. 90.

116. The importance of personal prestige in the culture of archaic Greece should not be underemphasized when trying to account for the architects' motivations to write a prose treatise. It is surely the case that Ephesus and Miletus followed the lead of rival Samos in building such religious monuments. Cf. also Hurwit 1985, p. 210.

117. Cf. Bammer 1984, p. 179. There is disagreement here, as in the case of the Samian Heraion, either with the particularities of measurement or the proper extremities formed by the rectangle; some measure from the lowest stair; others in terms of the smaller rectangle formed by the stylobate. I follow the excavators here as well. Bammer 1984, p. 183; and Akurgal p. 148: 180.9 by 377.4 feet (55.10m × 115m); Dinsmoor 1902/1950, in the appendix list, and Tomlinson 1976, p. 129: 55.1m × 115.14m; Robertson 1929/1983, p. 331: 55.10m × 109.20m.

118. Pliny 36.21.95–99.

119. This must surely be the case. Otherwise, where would Vitruvius (10.2.11–12) have gotten the details?

120. The technique, presumably, making use of *similar triangles*.

121. Cf. Coulton 1977, p. 143: "In spite of their place in the literature, the methods of Chersiphron and Metagenes were probably not widely used. Vitruvius says they were only possible because the quarries were fairly near to the building site (11 km at Ephesus, 13 km at Selinous), and obviously the longer the distance the greater was the

risk to the stone. Metagenes' architraves, up to 8.75m long and weighing up to 40 tons were supported only at each end and would be particularly vulnerable to a bump." Cf. also Cook 1982, p. 205: "Huge stone blocks had to be transported, hoisted, and fitted (at Ephesus the architrave blocks weighed up to forty tons). . . ." Whether one chooses to believe that the architrave was hoisted and fitted or rather dragged up a ramp and levered into place, the dimensions of the achievement are not in question.

122. Pliny 36.21,101–115.

123. Cf. Pryce 1928, I, 1, pp. 37ff.

124. Tomlinson 1976, pp. 130–131; Akurgal 1985, p. 148.

125. Cf. Aristophanes' *Birds*, 1002–1009. Meton is brought on stage for the purpose of ridiculing him. He carries a ruler and set-square and proceeds to square the circle for making a city-plan. His ideal is a rectangular grid, since this would be most rational, but also having circular streets so that each man could stand equally distant from power in the center. Meton, known to the Athenians as the calendar reformer, is presented as astronomer-engineer-*sophos*-city-planner. The chorus responds "This man's a regular Thales," and proves that to fifth-century Greeks this agglomeration of skills was entirely believable. Cf. also Vernant 1983, pp. 186ff, who discusses this passage in just this context.

126. For the first point, doubting the long list of achievements attributed to Thales, I here follow the objecting response by Greene 1992, pp. 93ff.

127. Greene 1992, p. 95.

128. Greene 1992, p. 104, with an eye to Thales specifically, sees all of his accomplishments as "modalities of the mastery of water." But, when Thales is seen, along with Anaximander, more broadly within the company of architects, the kinship is applied geometry.

129. I regard this view to be defective of Plato's attitude toward *technē* but nonetheless this is how such a view has been widely received and perpetuated.

130. Snodgrass 1980; Vernant 1962/82; Tomlinson 1976.

131. Cf. especially, Gagarin 1986, pp. 145–146.

132. Cf. above, chapter 1.

133. Homer, *Odyssey*, I.53ff; Hesiod, *Theogony*, 517ff; Pindar, *Pythian Odes*, I.39ff; Plato, *Republic* X, 616bff.

134. Vitruvius 4.1.5–6; also 4.1.6–7.

135. The *naos* is the dwelling place of the cult statue. In Latin, the *cella*.

136. McEwen 1993, pp. 118–119.

137. McEwen 1993, pp. 101ff.

138. Hersey 1988, ch.2.

139. Homer, *Odyssey*, I.53ff.

140. Hesiod, *Theogony,* 517ff.

141. Pindar, *Pythian Odes*, I.39ff.

142. Plato, *Republic* X, 616bff.

143. DK 12B5.

144. Vitruvius 4.1.5–6. Vitruvius twice likens the columns to naked men 4.1.6, 4.1.7.

145. Vitruvius 4.1.7. But see ch. 3 where the excavators have called into question Vitruvius's proportionate rule.

146. Cf. McEwen 1993, pp. 118–119 where she presents this interpretation, relying in part on Vernant 1982, p. 127. Vernant, however, does not discuss the matter with regard to the temple colonnade but rather to the agora, in which individuals stand equally from the center of power.

147. Herodotus 3.142.

148. McEwen 1993, p. 101.

149. Homer, *Odyssey* XI, 120ff.

150. For any of the readers who have ever taken the boat from the Peireus to Samos, you will know very well that after the boat passes Naxos and heads to the open sea . . . good luck! On more than one occasion, even on the very large ferries, when the sea came up, even seasoned travellers became sick as dogs. And I will never forget a ride I took from the port of Aiyali in Amorgos to Naxos on a small boat in very rough waters. Never again. In a plastic chair, not secured to the deck, I held onto a steel pole for dear life for eight hours! Thank God, I, unlike some of my compatriots, did not eat before setting out on that fiasco. These experiences reminded me of the anxieties that must surely have accompanied the seagoing colonizers, many of whom must have been landlubbers like myself. How many ships capsized in the swollen sea? How many died on their way to the new colonies on the west coast of modern-day Turkey? We can only guess. How many more traumatized transients headed from the mainland for their new home and who would never forget their journey, or set foot again on another seagoing vessel?

151. Pliny, *Natural History*, 36.31.

152. Casson 1991, pp. 77–78; Cf. also McEwen 1993, p. 102.

153. It is central to McEwen's far-reaching thesis to trace this "winged" structure back to legendary Icarus, and then to his father Daedalus. Her book *Socrates' Ancestor* offers to trace the origins of philosophy to an architectural inspiration.

154. McEwen 1993, pp. 107–113.

155. McEwen 1993, pp. 109–110.

156. Cf. McEwen 1993, p. 108.

157. Coulton 1977, p. 49; Dinsmoor 1950, p. 67.

158. Barber 1991, pp. 83ff; McEwen 1993, p. 112.

159. However, it may be objected that the dipteral colonnade is evidenced *internally* in Egyptian architecture. For example, in the famous temple of Luxor, the impressive courtyard/temple of New Kingdom Amenhotep III, the double peristyle is its defining feature.

160. *Lexikon der Aegyptologie*, vol 6, pp. 1160–1161.

161. Cf. also Plato*, Politicus*.

162. Pliny, *Natural History*, 12.1, 12.2

163. Burkert 1983, 3ff; cf. also 1987, pp. 150–176, for a discussion of ritual killing.

164. Hersey 1988, ch.2, pp. 11–45.

165. Hersey 1988, p. 45.

## Chapter Three
## The Techniques of the Ancient Architects

1. These expressions—*plan view* or *aerial view*—will be used interchangeably. They refer to a point of view distinct from others named by technical expressions such as *side view*, *elevation*, *oblique aerial view*, or *perspective*. The *oblique aerial view* is *slightly* from above, not directly above as is denoted by the term *plan* or *aerial view*; the oblique aerial view reveals at least one side in addition to a partial aerial view. The term *elevation* means the side (and front and back) view of a building. It is a term derived from orthographic projection and rooted in descriptive geometry. For architects, *elevation* stands for the vertical projection of the faces of building. It is one way of drawing the sides of a building. The several elevations, read together, describe its form. *Perspective* is also a term used in drawings to represent the form of a

building. It is a different type of projection entirely, in which the lines of the building appear to diminish with distance from the viewer. In perspective, at least two sides of a building are seen at once, and if from above, three. Both *elevation* and *perspective* are different from *section* or *cross-section*. In *perspective*, a circle reads as an ellipse. When the term *elevation* is used here, it connotes "side view," and integrated into that discussion, oblique aerial views, in which more than one side is pictured, slightly from above, are included. This is because the argument here attempts to distinguish the plan or aerial view from all other views, in order to grasp in ch. 4 Anaximander's imagination. One more technical point. For contemporary architects, the expression *bird's eye view* is understood to apply to perspective when the view is from above and to one side (as would be seen by a bird), and hence tends to coincide with an oblique aerial view. The plan view explored in this section, however, is strictly the aerial view and is to be distinguished from these other specific viewpoints.

2. Arnold 1991, p. 7.

3. Arnold 1991, p. 7.

4. Clarke and Engelbach 1930, ch. V.

5. If it is a curve, it can be accepted as a plan view; if it describes an arch, as some have suggested, then it is rather an elevation.

6. Badawy 1965, p.9

7. Clarke and Engelbach 1930, pp. 60–61. They make the point that although "foundation ceremonies are known in many temples of the dynastic periods, the most complete examples are found in the temples of Edfu and Dendera."

8. Badawy 1965, p.43; line drawing reconstructions, after Badawy.

9. Engelbach 1934, pp. 183–184.

10. Badawy 1965, esp. p. 58.

11. Badawy 1965, pp. 10, and 46–47.

12. Nelson 1981, I,1, Plate 22.

13. Lacau and Chevrier 1977, pp. 269–270, plate 311.

14. Arnold 1991, p. 8; Clarke and Engelbach 1930, p. 59, describe it as a "Landscape architect's project for a grove of trees in front of the XIth dynasty temple at Deir el-Bahari."

15. Clarke and Engelbach 1930, p. 57. A detailed plan of another estate, together with its restoration, is also provided (pp. 54–55), dating from the eighteenth dynasty tomb of Mere-Re at el-Amarna, and also a map—a plan—for the use of gold-miners during the reign of

Seti I (p. 58). The surviving plans help us to see how routine was the technique of imagining in plan, in several domains.

16. Clarke and Engelbach 1930, pp. 49–50.

17. The "fastened" doorways suggests that the plan was made *after* the tomb was completed, and it has been conjectured that *this* drawing was, therefore, perhaps not important for the construction process. But the plan could have been drawn early on, and the descriptions added upon completion.

18. Cf. Clarke and Engelbach 1930/1990, fig. 50.

19. Arnold 1991, pp 8 and 10; N. Davies, *Ancient Egypt*, 1917, pp. 21–25.

20. Kemp and Rose 1991.

21. Arnold 1991, p. 9.

22. Coulton 1977, ch. 3.

23. Petronotis 1972.

24. Iverson 1955, who led the way with his important study on the canon of proportions.

25. Robins 1994, esp. pp. 258–259, who followed Iverson but showed how more than one "canon" was operating and had changed, and was subsequently re-embraced, throughout different phases of Egyptian history.

26. Wesenberg 1974, p. 801: "Es steht ausser Frage, dass griechische Architecten gezeichnet haben."

27. If the architect made a plan on a piece of papyrus 18.5cm, for example, the plan would have had to be in proportion of 1:300. So, Petronotis's conjecture of using the pelt of a large cow would have made it possible to increase the scale, and thus facilitate the plan.

28. Heinrich 1967, pp. 24–45; and Wiseman 1972, pp. 145–147.

29. Wesenberg 1974, p. 800.

30. Coulton 1977, p. 54.

31. Coulton 1977, p. 55.

32. Wesenberg 1974, p. 798, esp. where he mentions that a series of previously observed line markings on the Parthenon had disappeared without a trace, and this destruction has occured within a mere fifty years!

33. Schneider, *Didyma* III, vol. 1, 1996, pp. 1–52.

34. Schneider, *Didyma* III, vol. I, p. 47.

35. Kienast 1985.

36. Reuther 1957, p. 19.

37. Kienast 1985, p. 112.

38. Kienast 1985, p. 111.

39. Kienast 1995, cf. also 1986/87, and 1978; cf. also Herodotus, 3.60.

40. Kienast 1986/87, pp. 232–237. The idea that Eupalinos perhaps invented his own unit of tunnel measurement, since this increment of measure is not in Samian ells or feet nor in any unit known from the mainland, is most interesting. Dilke 1987, p. 13, and 1985, p. 81, had suggested that if Anaximander made a terrestrial map that included marked-out distances, he would have needed some form of numeration, in abbreviated notation; Dilke then wondered if the Milesian form of numeration might not be traced back to Anaximander. The architects and the early philosophers were both involved in activities that plausibly led to their inventions of systems of mensuration.

41. Kienast 1995, p. 168. Cf. pp. 164–172 for his latest assessment of Eupalinos's solution. Kienast now contends that Eupalinos orchestrated the diversions in the north tunnel on a layout of an isoscles triangle. But cf. also 1986/87, pp. 231–232 for his earlier appraisal, which was modified significantly in the 1995 work.

42. Haselberger 1980, 1983, 1984, 1985.

43. Coulton, p. 53, and the same reasoning is reiterated on p. 58.

44. Haselberger 1985, p. 126.

45. Haselberger 1985, p. 126.

46. Haselberger 1985, p. 128.

47. Haselberger 1985, p. 129. The temple had no fewer than 120 columns and the bookkeeping records indicate the cost of 40,000 drachmas that he reckoned to be about a million dollars in 1980s wages.

48. Haselberger 1985, pp. 128–129.

49. Haselberger 1985, p. 128–b.

50. Haselberger 1985, p. 131.

51. Haselberger 1985, p. 132.

52. Haselberger 1985, pp. 126–129.

53. Haselberger 1985, p. 132.

54. Arnold 1991, p. 18.

55. Winlock 1955.

56. Tooley 1995, p. 57.

57. Winlock 1955, pp. 83–84, and plates 9–12.

58. Tooley p. 58.

59. Badawy 1972, Miscellanea Wilbouriana I.

60. Arnold 1991, pp. 9–11.

61. Arnold 1991, p. 11.

62. Wildung 1997, p. 157.

63. Clarke and Engelbach, p. 59.

64. Arnold 1991, p. 9, italics added.

65. Schattner 1990.

66. Benndorfs 1902, esp. pp. 175ff.

67. Pick 1904, pp. 1ff.

68. Blumner 1903, pp. 88ff.

69. Schlosser 1891, pp. 36ff.

70. Pausanias, X,5.9.

71. Strabo, VIII,7.2.

72. Schattner 1990, pp. 195–196.

73. Schattner 1990, p. 204.

74. Schattner 1990, p. 208.

75. Schattner 1990, p. 207.

76. Schattner 1990, p. 204, and Cat. #13; Cf. also Coldstream 1976, p. 11.

77. Schattner 1990, p. 217, and Cat. #46.

78. Cf. Schattner 1990, ch. 3, but the earlier research is already identified in ch. 1, by K. Müller 1923, (along with G. Oikonomos, and H. G. Payne).

79. Schattner 1990, p. 212.

80. Coulton 1977, p. 38; cf. also Rykwert 1996, p. 190; Schattner, Cat #6.

81. Cf. Rykwert 1996, p. 190; cf. also Schattner 1990, Cat. 1–4, Tafeln 1.

82. Cf. Schattner 1990, Cat. #s: 12, 13, 27, 37. Cat. #18 is probably from the early eighth century.

83. Schattner, Cat. #s 36–43. Pictured here is Cat. #38.

84. Schattner, p. 217, Cat. 46, but, see also Cat. #3 for contrasting but unusual style.

85. Coulton 1977, p. 55.

86. Herodotus, 5.62.

87. Coulton 1977, p. 57.

88. Cf. for example, Godley 1920, in the Loeb translation, and Greene 1987.

89. Schattner 1990, pp. 196–197.

90. Coulton 1977, p. 22, acknowledges that the sixth-century building programs were probably organized differently from the classical ones about which we are much better informed. He accepts the fact that aristocrats and their families likely played a more prominent role as patrons and supervisors of these archaic projects.

91. Coulton 1977, p. 55.

92. Haselberger 1985.

93. Coulton 1977, p. 55.

94. Cf. ch. 2, above, and in particular von Fritz 1971, pp. 401ff.

95. Coulton 1976, p. 302; also p. 303: "[W]e hear so little of *anagrapheus*, which is not mentioned in the accounts of the Erechtheion or the buildings at Epidauros, although *paradeigmata* are. . . . [I]t may be that a template was so much simpler to make than a specimen that it was not thought worth a separate entry; or perhaps it was supplied automatically by the architect at his own expense."

96. Heron, *Metrica*, 2, p. 126.22 (ed. H. Schone, Leipzig, 1903); cf. also Coulton 1976, pp. 302–303.

97. Coulton 1977, p. 55; cf. also Coulton 1976, p. 303.

98. Arnold 1991.

99. Arnold 1991, ch. 1, foonote 1, mentions Badawy 1965, and says, "Much useful information on this subject is in Alexander Badawy's *Ancient Egyptian Architectural Design*. . . ." But this is all he has to say in his study.

100. Badawy 1965, pp. 26ff.

101. Kemp and Rose 1991, p. 111. Dieter Arnold expressed the view to me that an important problem in Badawy's work is that he never actually measured the buildings themselves.

102. Kemp and Rose 1991, p. 112.

103. Kemp and Rose 1991, p. 126.

104. Kemp and Rose 1991, p. 126, italics added.

105. Kemp and Rose 1991, p. 127.

106. I am appreciative of some conversations I have had about Badawy's work and the kinds of reservations that Egyptologists have

expressed about it with Professors Candy Keller at Berkeley and Gay Robins at Emory, as well as Diane Wolfe Larkin. Professor David O'Connor at NYU was also gracious enough to offer his opinion that he regarded the regularities that Badawy detected to be less suspect.

107. Tomlinson 1989, pp. 22–23, sums up the rules of proportion in architectural design in one long paragraph!

108. Coulton 1977, pp. 22–23.

109. Coulton 1977, p. 59.

110. Lawrence 1957/1996, p. 91.

111. Gruben 1963; cf. also Lawrence 1957/1996, p. 91. Lawrence gives the numbers in feet: Heraion: 28 feet, 24 feet, and 17.5 feet; Artemisian: 28 feet, 24 feet, 20 feet. The diminution of column diameter: more than 6 feet, and then decrease by 5 inches, 6 inches, and 1 inch. Since the intercolumniation is measured from the center of one column to the center of the next column, the actual size of the opening between the columns would be proportionally smaller. Thus, at the archaic Heraion and Artemision, the central opening would have been approximately 22 feet, and then decreased to roughly 18 feet, and then 14.5 feet, but widened again to about 15 feet between the two side colonnades.

112. Cf. Coulton 1977, p. 66, also emphasized how the Ionic application of the rules of proportion seemed to differ from the application in Doric constructions on the mainland which followed a "modular system." In the Ionic application, "the rules do not relate to a single common module but form a sort of chain so that each element is derived successively from a preceding one, usually the immediately preceding one."

113. Coulton 1977, p. 64; Wesenberg 1986, pp. 40–41.

114. This point is also reemphasized by Wesenberg 1994, p. 92: "Modulus ist in der ionischen Version der untere Saulendurchmesser, in der dorischen die Triglyphenbreite."

115. The "Ionic Canon" was first set out by Krischen 1927, pp. 76, 89, and 1956, p. 68. The rules of proportion state that in the Ionic Order, when the entablature has no frieze, the lower diameter of a column equals a tenth of the column height. Cf. also Wesenberg 1983, pp. 23ff. who rehearses the sequence of debates about it.

116. Cf. Homer, *Odyssey* I.53, where we are told of the story of Atlas, guardian protector of the great columns that keep heavan and Earth apart. The same story is alluded to in Hesiod, *Theogony*, 517ff;

the distance between heaven and earth is reckoned in terms of the numbers 9 + 1, the number of days it would take a falling anvil to reach the earth from the highest heaven, 722–726. These issues are discussed below in ch. 4 along with Anaximander's numbers.

117. Gruben 1963, pp. 154–157.

118. Pliny, *N.H.* 36.21, 95–97; 36.56, 179; cf. also Vitruvius, III.3 and 5, and X.2.11–12.

119. Reuther 1957; Walter 1976.

120. Bammer 1984.

121. Reuther 1957, p. 60.

122. Gruben 1963, p. 154, and the comparative reconstruction drawings.

123. Gruben 1963, p. 157.

124. Reuther 1957, p. 60.

125. Wesenberg 1983, pp. 29–33.

126. Wesenberg 1996, pp. 40–41. Cf. also Vitruvius III,3.7 where he declares, "The columns themselves will be nine modules and a half in height."

127. Gruben 1996, pp. 70ff.

128. Dr-Ing. Peter Schneider, working with Tuchelt's team, shared this view with me in correspondences during November 1998.

129. Coulton 1977, pp. 32–33.

130. Coulton 1977, p.47, italics added.

131. Arnold 1991, p. 123.

132. Arnold 1974, p. 41.

133. Winlock 1941, pls. 15, 16, 24, 48.

134. Arnold 1991, p. 123.

135. Arnold 1991, p. 147.

136. Cf. Lawrence 1962, pp. 225ff; Orlandos 1965, II, pp. 100ff; Martin 1965, pp. 193–199; Coulton 1977, pp. 46–47.

137. Cf. Martin 1965, pp. 195–196.

138. For the general Egyptian technique of dressing large stones, cf. Clarke and Engelbach 1930/1990, pp. 99–109. Lawrence 1962, p. 225, claims that the *anathyrōsis* technique originates in Egyptian architecture (p. 47), but then modifies his position to note (p. 169, n.73) that Egyptian masonry does not present vertical joints prepared in this fashion but only on the outer face. His point is that since the blocks

do not have their rear faces dressed they do not exhibit true *anathyrōsis*. From Arnold's work we now know that, like Coulton, Lawrence was mistaken on this point.

139. Coulton 1977, p. 47.

140. Photo by the author. For other photographic evidence, cf. Nylander 1962, p. 74, fig. 59; cf. also pp. 72–74, figs. 56–60, and p. 47. The evidence comes from Crete, in Prinias, so-called temple A, and Dreros.

141. Orlandos 1968, II, pp. 100ff.

142. Orlandos 1968, II, p. 100.

143. Cf. Orlandos 1968, II, pp. 106ff; usually made of wood and sometimes of lead.

144. Cf. Schneider, DiskAB 6, 1996.

145. One common technique for the installation of column-drums consisted in the retention of four horn-like extensions called *ancones*, and of which we have examples still un-installed at the building sites. Ropes would have been tied around each of these "horns" when the lifting machine lowered them into place. When the drum was finally set in place, the *ancones* were removed and finishing efforts began in earnest. Cf. Orlandos 1968, II, p. 106.

146. Lambrinoudakis and Gruben 1987, esp. *anathyrōsis*, drum p. 575, Abb.7b, rectangular block pp. 590, Abb.28, and on bases, p. 593, Abb.36.

147. Schneider, *DiskAB,* 1996, p. 78.

148. Schneider, *DiskAB* 1996, pp. 80–83; the column-drum is 106.2 cm in diameter and 31.6 cm in height, roughly 3:1.

149. Buschor 1930, Beilage XXII, 1, and p. 86.

150. Kyrieleis 1981, pp.73–74. Cf. also the same image in Walter 1990, p. 125.

151. Reuther 1957, Tafel 2,2.

152. Kienast 1992, pp. 34 and 41. "The whole surface of the top layer shows clear signs of careful smoothing with a stone ax, the tool with which this material was most often worked. Towards the corners, the marks have been polished away, so that a good joint seal was achieved—without any *anathyrōsis*, which was only used in the seating joints. (Table 13.2)" Cf. also his note: "[F]or the seating edge, standard preparation with *anathyrōsis* is necessary."

153. *Catalogue of Sculptures*, 1928, vol I, part I, p. 37.

154. By kind permission of Professor Anne Ohnesorg 1997, 10,8: o. Inv. Nr. 83.

# Chapter Four
## Anaximander's Techniques

1. As Kahn put it, 1960, p. 96: "Anaximander clearly believed the universe was governed by mathematical ratios. . . ."

2. Sambursky 1956, pp. 13–16.

3. Sambursky 1956, pp. 13–14: "In the cosmology of Anaximander use was made for the very first time of the scientific model as a means of description or as a method for explaining phenomena." Cf. also Rescher 1958, pp. 718–731, and Brumbaugh 1964, p. 21.

4. Sambursky 1956, p. 15

5. Burkert 1972, p. 41: "The world of Anaximander . . . is essentially geometrical." Kahn 1960, p. 81: "Anaximander is ancestor . . . also to the geometric philosophy usually associated with the name of Pythagoras."

6. Cf. Kahn 1960, p. 96: "It must of course be admitted that (as far as we know) the celestial dimensions given by Anaximander cannot have been based upon any kind of accurate observation. . . ." Dicks 1970, p. 45 goes even farther to make the same point by denying him any sound knowledge of the astronomical concepts with which he is often credited. Also, Kahn 1970, pp. 99–116, responding to Dicks. Later, I agree with Couprie 1998, not that astronomical observation *motivated* his theory, but that the results could not simply defy common observations.

7. Brumbaugh 1964, p. 21; 1966, p. 18.

8. Burkert 1972, p. 419. Cf. also on the importance of geometrical conceptions for Anaximander's cosmology: Jaeger 1945, vol 1, p. 157; and Heidel 1940, p. 30.

9. Cf. Burkert 1972, p. 417n95: the assertion in the *Suda*, DK 12A2, that "in general [Anaximander] drew up the blueprint for geometry." As Burkert put it, with Anaximander "Cosmology is subject to mathematical logic . . ." for the first time.

10. Cf. Dickenson 1930, pp. 18–19: "The gods of Greece were beings essentially like man, superior to him not in spiritual or even moral attributes, but in outward gifts such as strength, beauty, and immortality. And as a consequence of this, his relations to them were not inward and spiritual but external and mechanical. In the midst of a crowd of deities, capricious and conflicting in their wills, he had to find his way as best he could. There was no knowing what a god might want; there was no knowing what he might

be going to do. If a man fell into trouble, no doubt, he had offended somebody, but it was not easy to say whom or how; if he neglected the proper observances no doubt he would be punished, but it was not everyone who knew what the proper observances were. Altogether it was a difficult thing to ascertain or move the will of the gods, and one must help oneself as best one could. The Greek, accordingly, helped himself by an elaborate system of sacrifice and prayer and divination, a system which had little connection with an internal and spiritual life, but the object of which was simply to discover and if possible to affect the divine purposes. This is what is meant by saying that the Greek view of the relation of man to the gods was mechanical."

11. Jaeger 1945, I, ch.9 "The Discovery of World Order," p. 152: "[T]he growth of Greek philosophy . . . [is] the process by which the original religious conception of the universe, the conception implicit in myth, was increasingly rationalized." Cf. also Jaeger 1936, p. 23; Robin 1928/1967, p. 32, Greek philosophy begins with the demythologizing of the Ionians, and this tendency leads to rational explanation; Cornford 1952, pp. 186–189, Ionian philosophy arises as a rationalization of ancient creation myths; Guthrie 1962, pp. 29, 40, the habit of natural explanation develops the habit of generalization, and thus the consciousness of universals, while mythic explanations remain personal and particular; Kirk-Raven 1957, pp. 98, 72–73, "Thales evidently abandoned mythic formulations: this alone justifies the claim that he was the first philosopher, naive though his thought still was."

12. Cf. Sourvinou-Inwood 1983, p. 35, makes the important point of the Homeric context against which such ideas represent a significant departure. Man's only real guarantee and defense against chaos and human helplessness is, Odysseus recommends (*Odyssey*, 18, 130–142), respect for and acceptance of the divine order and justice. For Homer, if there is an underlying order, humans are incapable of grasping it. The political message is clear: accept the social order in which you find yourself. The Milesian insight of human capacity offered a challenge to this very ethos.

13. The bridges were completed by Cyrus, but not until c. 520 BCE. Cf. Greene 1992.

14. *Iliad* 18, 470ff. The shield was described as a "representation of the world" already in antiquity. Cf. Hardie 1985, who suspects as early as Cratos of Mallos.

15. Socrates remarks in the *Theaetetus* 154E that Homer was the first Heraclitean, and elsewhere that his poetic renderings were open to allegorical interpretations, *Republic* 378D.

16. Cf. the brilliant and eloquent article by Clay 1992, esp. p. 133.

17. The shield itself may have appeared raised as layers of metal were hammered at the blacksmiths' shop.

18. Cf. also Clay 1992, p. 134, where he mentions the shield sketch by Alexander Pope.

19. Cf. Heidel 1937, p.2.

20. Homer, *Iliad* 8, 13–16.

21. Homer, *Iliad*. 8, 13ff; 18, 607ff; 21, 194ff; 14, 200ff.

22. Cf. Dicks 1966, pp. 26–40, for a pessimistic view of the possibilities of astronomical knowledge in any way based on mathematical considerations.

23. Cf. Snell 1953, pp. 227–230, who defends this point as central to his thesis. In the chapter entitled "The Origins of Scientific Thought" he argues that the development of the definite article from the demonstrative pronoun via the specific article into the generic article made possible the linguistic formation of substantive nouns. These are the stable objects of thought for philosophy and science. Snell argues that the language of Homer and Hesiod do not display this grammatical formation. And so, in his estimation, Homer and Hesiod could not find their way to these kinds of questions.

24. Cf. Vlastos 1947/70, pp. 73–80, esp. 75; Cornford 1952, pp. 202–214; Thomson 1955, vol.2, pp. 148–153; Kirk-Raven 1957, pp. 24–33; Guthrie 1962, p. 38; Stokes 1962, pp. 1–16; Jaeger 1967, pp. 10–18; Hussey 1972, pp. 11–13; West 1972, pp. 203–206; Furley 1987, p. 18.

25. Cf. also Hesiod *Shield*, 139–320 where the shield of Heracles is treated in a manner analogous to Homer's treatment of Achilles'. But, on the question of authenticity, cf. Cook 1937, pp. 204ff. who champions the position of Aristophanes of Byzantium in denying the poem to Hesiod.

26. Hesiod, *Theogony*, 722–726.

27. Homer, *Iliad* 2, 327ff.

28. Homer, *Odyssey* 14, 240ff.

29. Homer, *Iliad* 1, 52ff.

30. Homer, *Odyssey* 9, 82ff.

31. Homer, *Odyssey* 10, 27ff.

32. Homer, *Odyssey* 12, 446ff.

33. Homer, *Odyssey* 14, 228ff.

34. Homer, *Odyssey* 10, 19; 10, 390; 14, 247.

35. Homer, *Odyssey* 16, 327ff., for nineteen years; 16, 206 and 23, 170 for the twentieth year.

36. Hesiod, *Theogony*, 790, where the selection of "9" swirling streams signifies a great multitude.

37. Homeric *Hymn to Demeter*, 47–51.

38. Hesiod, *Theogony*, 775–805.

39. Cf. Homer, *Iliad*, book II and elsewhere. Cf. also Vernant 1983, p. 185.

40. Robinson 1968, p. 10. But symmetry in *distance* is no argument for symmetry in Tartaros's shape.

41. McKirahan 1994, p. 13. Again, there is no evidence in Hesiod for a hemispherical Tartaros.

42. By taking this stand, I am rejecting Homer's treatment of the construction of the shield-as-world with cosmogony proper. To do so, however, is at once to recognize his analogous descriptions as forerunners that help make sense of the advances of Hesiod and Anaximander in these matters.

43. Here I draw on the important work of Miller Jr. 1978/83, pp. 131–142, esp. 131–136, and 1997.

44. Hesiod, *Theogony*, 116–133 (following the Lattimore translation; however, for γένετ' "came-to-be").

45. Hesiod, *Theogony*, 721–725

46. Hesiod, *Theogony*, 726–728; 807–813.

47. Cf. Kurtz and Boardman 1971, p. 72, from which the specific burial amphora is taken. In Hesiod, three ringlets are described, while the amphora on p. 72 has only two.

48. Cf. Vernant 1983, p. 179, who argues just this point about the subterranean world conceived as a jar. "One could believe, as Hesiod did, in a huge jar that ended in a narrow mouth from which grew the roots of the world. . . . Within the jar whirlwinds blew in all directions: this was the world of disorder, of space not yet organized. The cosmogonies relate, in fact, how, once Zeus had become King of the universe, he closed the neck of the jar forever so that the subterranean world of disorder—the world where every spatial dimension

is muddled in an inextricable chaos, where up is confused with down and right with left—should never more emerge into the light of day. . . . The subterranean world that the jar symbolizes is the world from which the plants grow up, where seeds germinate, and where the dead dwell."

49. I would also like to mention another possible interpretation that might be taken up by someone down the line if one could link Hesiod and Orphism. It might be that the overall picture of Hesiod's cosmos should be imagined as an egg. While the evidence for the cosmic egg has support in Orphic cosmogony, there is no textual evidence in Hesiod for it. However, we do have testimony that connects a version of a Hesiodian cosmogony with the egg in later authors, and the suggestion is tempting. In Aristophanes' *Birds* (693ff.), the chorus of birds declares, "First of all was Chaos and Night and black Erebos and wide Tartaros, and neither Ge nor Aer nor Ouranos existed; in the boundless bosoms of Erebos black-winged Night begets, first, a wind-egg." Then, Eros mingling with gloomy Chaos and broad Tartaros *hatched out* our race. This certainly proves that cosmogonical stories sharing similarities with Hesiod and involving an egg were believable to a fifth-century audience, but this must leave open the question of whether it would have been meaningful to Hesiod's audience some two centuries earlier. Cf. also Kirk-Raven 1957, p. 44, where attention is drawn to a report that Epimenides of the late sixth century BCE proclaimed a cosmogony in which Air and Night produce Tartaros, then the Titans, from their conmingling produces a cosmic egg from which all other offspring emerge. The suggestion of the egg imagery it must, of course, remain only a conjecture. But, to a farmer like Hesiod the cracking of an egg produces the gap from which life emerges. The gap created is not merely suggestive of his cosmogony but moreover would be a ready-made image for his archaic audience to grasp. When an effort is made to imagine the picture generated from the poet's song, we need to remind ourselves that the poet sings for an audience and that the accessibility of the imagery that drives the poet is indispensable to the understanding of his audience.

50. The issue of the changing altitude of the sun will be taken up in the next section when we consider the "elevation" perspective.

51. DK 12A9, 12A10, 12A11.

52. κίνησιν ἀίδιον ἐ̑ιναι, DK 12A11. I have chosen to use the chariot wheel structure to supply an image for eternal motion since it is one that Anaximander calls upon at a later stage to illuminate his model.

53. Even if one accepts the more narrow reading by Holscher 1970, and provisionally accepted by Lloyd 1970, pp. 265–266, that perhaps "hot and cold, wet and dry" are terms too abstract to extend to Anaximander while expressions such as "fire" and "mist" might be more appropriate, there is no disagreement that fundamentals in *opposition* (to use Lloyd's parlance) characterize the early stages of separation.

54. ἐκ τοῦ ἑνὸς ἐνούσας τὰς ἐναντιότητας ἐκκρίνεσθαι, Aristotle, *Physics*, 187a20ff.

55. ἀλλ' ἀποκρινομένων τῶν ἐναντίων διὰ τῆς κινήσεως, DK 12A9, 12A10.

56. Of all the commentators, Rescher 1958, pp. 719–725, alone, provides stages of Anaximander's cosmic development.

57. φλογὸς σφαῖραν περιφυῆναι, DK 12A10.

58. ὡς τῷ δένδρῳ φλοιόν, DK 12A10.

59. DK 12A27, on the authority of Theophrastus, Alexander of Aphrodisias reported that "the sea is what is left of the first moisture; for when the region about the earth was moist, the upper part of the moisture was evaporated by the sun τὸ μέν τι τῆς ὑγρότητος ὑπὸ τοῦ ἡλίου ἐξατμίζεσθαι; DK 12A27 continues with the report by Aetios that "Anaximander held that the sea is the remaining of the original flooding, the fire has for the most part dried this up." Cf. also Sambursky 1956, pp. 9–11, who details the role of evaporation in the stages of cosmic evolution.

60. DK 12A10.

61. ἁρματείῳ <τρόχῳ> κοίλην ἔχοντι τὴν ἁψῖδα, DK 12A22, and 12A21.

62. πρηστῆρος αὐλός, DK 12B4, 12A21, 12A22. Interestingly, like Homer and Hesiod, Anaximander also takes us back to the workshop of Hephaistos to illuminate the world picture.

63. τὸν μὲν ἥλιον ἴσον εἶναι τῇ γῇ, DK 12A21, (and presumably the moon?). Cf. Naddaf 1998 for the clearest and most persuasive discussion in the literature so far.

64. λίθῳ κίονι τὴν γῆν προσφερῆ, DK 12B5, στρογγύλον, κίονι λίθωι παραπλήσιον, DK 12A11.

65. κυλινδροειδῆ, ἔχειν δὲ τοσοῦτον βάθος ὅσον ἂν εἴη τρίτον πρὸς τὸ πλάτος, DK 12A10.

66. Kirk-Raven 1957, p. 134. Cf. also Burkert 1972, p. 417.

67. Cf. O'Brien 1967, pp. 424–425; Dumont 1988, p. 28; and Wright 1995, p. 39, who comes close to interpreting the size of the

earth to be "1 × 3." These interpretations rest on translating κίονος λίθωι as "stone column" and render DK12A10 as 1 × 3 whereas most of the commentators translate, more appropriately I believe, "column-drum."

68. On the authority of Hippolytus I,6, 4–5 (εἶναι δὲ τὸν κύκλον τοῦ ἡλίου ἑπτακαιεικοσαπλασίονα <τῆς γῆς . . .> and Aetius II,21,1 (the sun's circle is ἑπτακαιεικοσαπλασίω τῆς γῆς). The meaning of this expression could apply equally well to the earth's diameter or circumference. Cf. Naddaf, *JHI*, 1998.

69. I am following the ingenious interpretation of Couprie 1998.

70. DK 12A11, 12A21. Naddaf 1998, also proposes an ingenious solution by distinguishing between *distances* from the heavenly wheels as opposed to *sizes* of those wheels. When a diagram is attempted, however, we have to consider that the size of the wheel also consists in *aer* and the difference, for instance, between the apparent size of the sun, said to be equal to the earth, and the size of the sun wheel. Naddaf sets out the whole discussion with great care but the result he advocates poses too great an observational discrepancy. Of course, he does not regard this as a problem since he believes that intelligibility, not accuracy, is the matter at stake and Anaximander's utopian agenda renders criticisms concerning accuracy of little moment.

71. We have no text that gives us the number nine for the wheel of the stars but almost all commentators have accepted this reasonable, proportional inference.

72. I agree with O'Brien 1967, p. 425, that when we discuss these numbers for Anaximander the most important point is that we compare like with like so that the proportions remain the same.

73. I am following Couprie 1998, who uses just these phrases; I also conclude that the *distance* to the sun is twenty-seven earth-diameters.

74. I want to distinguish two questions: (1) "How should we account for the number series 9, 18, 27?" (2) "How should we account for the remarkable order of *stars*, moon, and sun?" The answer to this second question is, perhaps, to be gleaned from Zoroastrian sources; cf. the reasoning offered by Burkert 1963, pp. 106ff, and supported by those such as Furley 1987, p. 28. But cf. also Schmitz 1988, pp. 77–78, and earlier Duchesne-Guillemin 1965, p. 425ff, for the intriguing rebuttal that perhaps the Avestan texts incorporated Anaximander's ordering, and not the other way around, on the arguable grounds that the relevant Zoroastrian texts are later than mid-sixth century. The answer to the first question is distinct and I pursue that in what follows. But, being

sympathetic to the suggestions by Burkert, Furley, West, *et alia*, I agree that Anaximander integrated different traditions and approaches, and the details must be sorted out on a case by case inspection.

75. Diels 1923, pp. 65–76, esp. 72. This hypothesis seems to have first been formulated by Tannery 1930, p. 91; and enjoined by many scholars including Heath 1913, p. 38; Burnet 1930, p. 68; Robin 1923, p. 62; Cornford 1952, p. 164; Sambursky 1956, pp. 15–16; Burkert 1963, pp. 97–134; Guthrie 1962, p. 95; West 1971, p. 89; Furley 1982, p. 28.

76. Gigon 1945, p. 91; Couprie 1998, shares with Gigon a similar assessment of the Hesiodic origins of the "9."

77. Naddaf 1998, pp. 1–40.

78. Eggermont 1973, pp. 118–128.

79. In the solar year, 12 months of 30 days; in the sidereal year 13 months of 27 days each is approximately equal to 360. Cf. Nilsson 1920, pp. 260–265; and Borger 1964, pp. 317–330.

80. Eggermont 1973, p. 126.

81. Cf. Naddaf 1998, whose original thesis follows the lead of Gomperz 1943, p. 167, on the grounds that Gomperz was the first to link cosmology with a sociopolitical model. For him, the cosmos is like a city, surrounded by walls, with an equilibrium of rights and injustices, and in which violations must be avenged.

82. Naddaf 1998; cf. also Vernant 1963/1983, pp. 125–234, where the sociopolitical thesis was detailed earlier but the identification of *three* classes is uniquely Naddaf's.

83. Hoephner and Schwandner 1986, Introduction and pp. 11–13, 17–19. According to their findings, the increasing trend toward democratization throughout the archaic/classical periods found expression in city planning and specifically in terms of the distribution of houses.

84. Vlastos 1947, pp. 156ff.

85. Some have also embraced the centrality of the number three on principally astronomical and observational grounds, rather than mythical and poetic ones; they include Burch 1949–50, p. 154; R. Baccou 1951, p. 77; Lloyd 1970, p. 28; Conche 1991, p. 218. I agree with Naddaf 1998, that astronomical and observational grounds are doubtful, although Anaximander's hypothesis certainly had to "save the phenomena." For this sort of reason I think Naddaf was mistaken to include Couprie 1995, pp. 159–160, with this group; Couprie is only maintaining that the numbers must not conflict with simple observation.

86. Kirk-Raven 1957, p. 134.

87. Cf. Couprie 1998 who uses just these phrases and in just this sense.

88. On the authority of Hippolytus, DK 12A9, and Aetius from one of his doxographies, DK 12A21.

89. On the authority of Aetius from another doxography, DK 12A21.

90. On the authority of Aetius from another doxography, DK12A22.

91. Cf. Naddaf 1998 for the most thorough presentation of the debate. I rely on his article for this discussion.

92. Couprie 1998.

93. Tannery 1887/1930.

94. Cf. Naddaf 1998 where he assembles Tannery 1887/1930, Burnet 1945, Diels 1897, and Heath 1913. Perhaps also Kahn 1960, and Conche 1991.

95. Kirk-Raven 1957, p. 136.

96. Rescher 1958, p. 727; Couprie 1998.

97. The spoiler seems to be Kirk-Raven1957, p.136 who argues these numbers would hold if radii, not diameters, were meant but clearly diameters are meant and hence two, not one should be added to the multiples, hence twenty-nine, not twenty-eight for the sun. But cf. Couprie 1998 who argues that the thickness of the ring should be one-half an earth diameter, and hence the numbers can still be preserved.

98. Cf. Hahn 1995, pp. 93–136, esp. 97–98.

99. Homer, *Odyssey*, 1, 53ff.

100. Hesiod, *Theogony*, 517ff.

101. Pindar, *Pythian Odes*, 1, 39ff.

102. Plato, *Republic*, X, 616Bff, a Pythagorean vision.

103. See chapter 2 for a discussion about the symbolic meaning of the temple.

104. Cf. chapter 3 above.

105. Diels 1897, p. 236, and 1923, pp. 65–76. Similar drawings appear in de Raedemaeker 1953, p. 115, and Krafft 1971, p. 115 and are inspired by Diels. Diels's drawing here is the one refined by Couprie who adds the depth of the column-drum earth and the rays of the sun.

106. Rescher 1958, pp. 722–724, esp. 724. Interestingly, I came to my own picture long before I became aware of Rescher's graphic display. In any case, the context of the (outlines of the) picture that we share is quite distinct.

107. Rescher 1958, diagram on p. 724. The reason he tries to present the *apeiron* as formful is that he accepts the interpretation by Tannery 1930, p. 104, that the *apeiron* was an air-like fluid. This committment is made abundantly clear when he further embraces (p. 723, n.15) the view of Cornford 1929, I, p. 234: "Anaximander held that his infinite stuff existed in its undifferentiated state outside our world, which envelops it." I regard it as an error in graphic representation to display an "undifferentiated" as a definite form.

108. DK 12A6 where he is credited with the making of a *pinax*.

109. DK 12A10.

110. The *anathyrōsis* and *empolion* techniques have been detailed above, ch. 3. This example is repeated to clarify the argument presently before us.

111. Cf. Orlandos 1968, vol. 2, pp. 100ff; cf. also chapter 3.

112. DK 12A11.

113. DK 12A11, and cf. vol. 1, p.82n; Kirk-Raven 1957, p. 134.

114. For the discussion of the *empolion*, cf. Orlandos 1968, vol. 2, pp. 106ff.

115. Pliny, *Nat. Hist.* xxxvi.21.95, although the excavators found evidence of neither sheepskins nor charcoal.

116. DK 12A26, *de Caelo*, II. 13, 295b10ff . For the translation of *omoiotēta* various renditions have been proposed: "Similarly": Kahn 1960, pp. 76, 79n3; Lloyd 1978, p. 68; "Indifference": Guthrie 1962, p. 98; Furley 1989, p. 16; Robinson 1972, p. 111, and 117n1; "Equilibrium": Vlastos 1953/1970, p. 75; Kirk-Raven 1957, p. 134; "Equal Distance": Cornford 1952, p. 165; "Equiformity": Dicks 1970, p. 44. Other renditions include "likeness" and "uniformity." Despite the variety of translations, the meaning does not seem to be in doubt. Hippolytus (DK 12A11) also expresses the same view, perhaps echoing Aristotle, when he claims that Anaximander held that the earth was at rest in the center because it is not dominated by anything (ὑπὸ μηδενὸς κρατουμένην) being equidistant from everything (διὰ τὴν ὁμοίαν πάντων ἀπόστασιν).

117. Simplicius, *de Caelo*, 532.13.

118. Aristotle, *de Caelo*, II.13, 295a7ff. For other discussions on the vortex, cf. also Baldry 1932, pp. 27–34; Vlastos 1947, pp. 156–178; and Ferguson 1971, pp. 111–112.

119. Furley 1987, pp. 23–28; 1989, pp. 14–22. Cf. also Ferguson 1971, pp. 97–115.

120. Heidel 1906, pp. 279–282; and 1937, pp. 7–8, and 68–69 supports the vortex theory. But he also recognizes a problem with the view: "The bands, in which the heavenly bodies were situated, were, however, not in the positions presupposed in the hypothesis of the vortex, for they were obviously not in the same plane as the terrestrial disk" (p. 8). While not rejecting the vortex model for Anaximander and the Ionians, he tries to salvage the position by insisting "This fact was explained by the assumption of a dip (egklisij) of the earth to the south, which brought the sun, for example, above the horizon during the day. . . ." Heidel's position is embraced by Rescher 1958, pp. 722, though he modifies it to join a chorus with Burnet 1892/1945, pp. 61–62, who insists that while motion is eternal for Anaximander, the vortex arises only with the formation of the cosmos but not before it.

121. Robinson 1971, pp. 111–118, first presented at a meeting of the SAGP in 1953, emphasized the incongruity of the assertions that the earth is cylindrical, not spherical, and yet according to Aristotle, is equidistant from all extremes.

122. Aristotle, *de Caelo*, II.13, 295b10–17.

123. Furley 1987, p. 26; Simplicius, *de Caelo*, 532.13 "Anaximander thought that the earth remains in place *because of the air that supports it* and because of its equilibrium and uniformity" (Furley's italics). Cf . also Aristotle's discussion of the vortex in the passage that just precedes his identification of Anaximander in *de Caelo*, 295a7ff.

124. Aristotle, *de Caelo*, 295a7ff.

125. DK 13A6, 13A7.

126. Furley 1987, p. 26.

127. The expression ἐκ τούτου φλογὸς σφαῖραν περιφυῆναι seems to run jarringly into ὡς τῶι δένδρωι φλοιόν, DK 12A10, from Psuedo-Plutarch.

128. K-R-S (2nd ed.), p. 134.

129. Guthrie 1962, I. pp. 99–100.

130. Lloyd 1979, p. 68, but guardedly.

131. McKirahan 1994, p. 40.

132. Naddaf 1998.

133. Couprie 1995.

134. Cf. Cherniss 1944, for the many accounts in which Aristotle misreports or misrepresents the doctrines of his predecessors.

135. I recall distinctly that when I first began studying the archaic temples I searched for patterns and numbers by counting the number of columns and compared the arrangements on the front and back, and on the sides. Later, I came to the conclusion that from the point of view of *visual perception* the number of *spaces*, not the number of columns, was far more decisive and striking in the emerging pattern. In the front of the temples, there were eight columns, but this is not what would visually strike a person upon approaching. Rather, there would be two spaces opened left and right by the dipteral colonnade, while inside there would be three central spaces, two of which flanking the door (left and right) would be opaque because of the walls of the *cella* and the center would open to a doorway. The patterns that greet the oncomer are five, or even two left and two right with three in the center of which the most central space is transformed when the great doors open to the cult statue at time of sacrifice.

136. The four mentions of Anaximander by name in Aristotle: *Physics* 187a20ff; 203b14; *de Caelo*, 295b12; and *Metaphysics* 1069b22.

137. Oblique aerial perspective is *slightly* from above, and hence quite distinct from aerial perspective, which offers the view directly overhead.

138. Just a note of reminder. The argument requires that we distinguish the plan view from all other views. In this section, and in the absence of ancient drawings or models of Anaximander's cosmos, we survey suggestions about how the cosmos might have been imagined. Any and all images *other than plan views* are to be entertained. The term *perspective* has a technical meaning for contemporary architects. It is a term used in drawing to represent the form of a building. Compared to an *elevation*, a term derived from orthographic projection and rooted in *descriptive geometry*, perspective is a different type of projection entirely. Perspective is also a term used in drawing; it refers to the representation of the form of a building in which the lines of the building appear to diminish with the distance of the viewer. In perspective, unlike elevation, at least two sides of the building are seen at once, and if from above, three. An *axonometric projection* is a vertical projection that is not an elevation.

139. Almost all the drawings in the scholarly literature, with the important exceptions of Diels (1897, 1923) and Rescher (1958),

which we have already considered above, are some species of *elevations*, not plan views: cf. Sartorius 1883; Neuhauser 1883; Schultz 1907; Heath 1913; Mugler 1953; Krafft 1971; Szabo 1977; McKirahan 1994; Couprie 1989, 1995.

140. The main point is that the frame of the earth was determined by a three-point coordinate system: (1) the points of sunrise and sunset on the summer solstice, (2) the points of sunrise and sunset on the winter solstice, and (3) the points of sunrise and sunset on the equinoxes. The outside frame was established principally by the solstice measurements and the equinox markings played a lesser role. But, just as in the *anathyrōsis* technique, the equinox measurements provided a second or coordinate measure to further secure the reliability of the determination of risings and settings on the solstices.

141. Heidel 1937, p. 8.

142. Cf. Vernant 1983, pp. 177ff. when he specifically addresses the astral religion of the Babylonians.

143. According to later commentators, the early map makers apparently distinguished between a map of the earth (γῆ) and a map of the inhabited earth (οἰκουμένη). Cf. Heidel 1937, p. 12. The fact that Anaximander is credited with the latter is further evidence for his concern for the human domain of such matters and not simply as an abstraction.

144. Cf. Kahn 1960, p. 82, The neo-Babylonian map dates to the Persian period, c. 600–400 BCE; also Clay 1992, pp. 131–138.

145. Herodotus II,36.

146. Cf. Thrower 1972, pp. 11–13, where he provides examples of both Egyptian and Mesopotamian maps dating to much earlier times.

147. Cf. West 1971, pp. 19 and 49, for the conjecture about Pherecydes map, discussed above ch. 2.

148. Homer, *Odyssey*, 18, 470ff.

149. DK 7B2.

150. Homer, *Odyssey,* III.169–172.

151. Cf. Heidel 1937, p. 56. Here, and in what follows concerning early map making, I am indebted to Heidel's work.

152. Aristotle in the *Meteorologica*, II.6, 363b12ff, gives a complete wind rose when he explains his map of the earth. In addition to Zephyros, Boreas, Notus, and Eurus, he also mentions Etesian, Apeliotes, Aparctias, Caecias, Argestes, Olympias, and Sciron. Cf. also II,5, 361b14ff.

153. Bradford 1963.

154. Severin 1987.

155. Severin 1987, p. 235, and chapter 14 in general, pp. 235–245.

156. Cf. the skepticism voiced by Dicks 1966, pp. 30–33. Although Dicks grants that Anaximander might have been able to mark out the solstices "since it implies no astronomical theory whatsoever" (p. 31), he is very dubious about the equinoxes. He rightly points out that, observationally speaking, when the sun reaches its northernmost point in its annual path it will remain at this point on the horizon for several days in succession before slowly shifting southward, and vice versa. He also insists, rightly, that this observational feature is not characteristic of detecting the equinoxes since they are not conveniently marked by an apparent halt. But Dicks's position does not diminish the force of the argument here. For Anaximander's map required only a rough guess about the marking points to make an earthly frame, and a seasonal sundial would focus his attention on the horizon points corresponding to the solstices, and midway markers on the horizons that would be suggested by the equinoxes, however imperfectly calculated.

157. Aristotle, *Meteorologica*, II.6, 363b1–11. The translation is that of H. D. P. Lee in the Loeb Edition, 1978. I do not provide a diagram here since it would be distracting to the line of argument since Aristotle's construction would be represented on a spherical earth. But cf. Lee's diagrams, pp. 181 and 187.

158. Heidel 1937, p. 56.

159. I am endorsing this interpretation, traceable to Zeller 7th ed/1923, I, p. 223, that the winds, not the vortex, account for the turnings of the sun. This has become the predominant view among scholars.

160. DK 12A27. Significant disagreements in the scholarly literature have centered around the question of how to interpret τροπας ηλιου. Do the "turnings" refer to the general motions or do they signify the solstices? For the debate among nineteenth-century scholars, see Heath 1913, p. 33.

161. Aristotle, *Meteorologica*, II.5 and 6. Should anyone find incredible the view that the winds could be sufficiently powerful to change the course of Anaximander's sun wheel, we need only be reminded that Aristotle held the view that the famous meteorite at Aegospotami, far from being a celestial object, was rather a huge stone carried by the winds upward to the ring of fire, and so also for an

account of comets, I,7, 344b30ff. Cf. also West 1960, pp. 368–369 on Anaxagoras and the meteorite of 467 BCE. Again, for Aristotle, the winds account for earthquakes, II,8, 365b21ff.

162. DK 12A1 and 12A2.

163. Herodotus II,109.

164. Neugebauer and Parker 1960, pp. 116–121; also Neugebauer 1941, p. 28. Cf. also Powell 1940, pp. 69ff. who characterizes the whole phrase of Herodotus as an Alexandrine interpolation.

165. Leach 1954, pp. 112–113. Cf. also the discussion of the *merkhet* or slit palm leaf and plumb line, in Leach p. 122, and Aaboe 1974, pp. 21–42.

166. DK 12A1. Cf also Yalouris 1980, pp. 313–318, and Schaus 1983, pp. 85–89, who point to painted vases depicting scenes with truncated columns/drums, dating to the mid-sixth century, and wonder if they were perhaps inspired by Anaximander's visit to Sparta.

167. Gibbs 1976, p. 6.

168. Vitruvius I.6, 1960, pp.7–8.

169. Gibbs 1976, p. 6.

170. Gibbs 1976, pp. 6–7, 94n.12. Gibbs is referring to a report by D. S. Hunt who discovered in 1938 this *analemma* in a well on Chios. Hunt's report gives only a verbal description which is illustrated here, I believe, for the first time.

171. van der Waerden 1953, pp. 216–230.

172. Cf. Heidel 1937, pp. 2–59, who gives all the specific details.

173. Of course, he might have had neo-Babylonian models also in mind but this he does not say.

174. Herodotus IV, 42.

175. DK 12A6.

176. Dilke 1987, p. 13. Cf. also Kienast 1986/87, pp. 232–237, who suggested the possibility that Eupalinos, c. 530 BCE, might have invented his own tunnel measure based upon the marking systems observed throughout the tunnel in Samos. For ancient systems of numeration, cf. Tod, 1979; for an imaginative interpretation of architectural "numbers" see Hertwig 1968, Warren 1976.

177. Cf. also the diagram drafted by Nina Thiel in Brumbaugh 1964, p. 22, with coastlines based upon Heidel's conjecture.

178. The five drawings that I now consider are discussed in detail by Couprie 1995. Although my purpose, unlike Couprie's, is to distinguish

plan from elevation drawings in the context of architectural technologies, I am indebted here to his presentation of these scholarly efforts.

179. Szabo 1977, pp. 500–529. Drawing as corrected by Couprie 1995, p. 165.

180. Vitruvius 1960, IX, 8, p. 271. Cf. also Cohen and Drabkin 1948, pp. 135–136, who point out that in the sophisticated *polos* that Vitruvius presents, the dial stick is placed in a hemishpere the rim of which is parallel to the horizon. There is no report that Anaximander was acquainted with the *polos* although Herodotus states (II, 109) that the Greeks received the knowledge of it from the Babylonians; and more importantly, the hemispherical container is inappropriate for Anaximander.

181. Sartorius 1883, p. 228; but the image provided here is the one modified by Heath 1913, p.34.

182. Cf. the detailed discussion and criticism in Heath 1913, pp. 33–35, and in Couprie 1995, pp. 166–168.

183. Neuhauser 1883, pp. 427–428.

184. For a more detailed discussion, see Couprie 1995, pp. 168–172.

185. Heath 1913, p. 35, not the specific one pictured above, although similar.

186. Mugler 1953, p. 14.

187. Krafft 1971, p. 301ff. Cf. also Salzer 1990, pp. 61–70, esp. 67.

188. Heath 1913, p. 35; West 1971, pp. 85–86.

189. Couprie 1989, 1995, 1998.

190. Eggermont 1977, pp. 118–128, esp. 120. Eggermont's image is a freeze-frame success but nothing in his essay suggests that his image is a conscious response to the required conditions outlined immediately above.

191. Furley 1987, I, p. 26.

192. This is a crucial point of the interpretation I am advocating. For this reason, scholarly luminaries such as Kahn 1970 p. 107, are just mistaken. ("Anaximander's world is spherical . . .") Kahn almost accepts the cylindrical picture but dismisses it on the grounds that it is "unattested," is "incompatible with celestial symmetry since the cylinder would have to be set obliquely to the plane of the earth." Had he thought through the model in plan and elevation he might have recognized that the confusion in conception that troubles him arises

only when the two perspectives are not considered separately. The plan view preserves the illusion of uniformity and circularity, but the model is cylindrical. Further, the claim that a cylindrical model is not attested is undermined by the testimony that the "sphere" of fire surrounded the earth like "*bark around a tree*."

193. West 1971, pp. 85–86.

194. Couprie has hedged on this one. In 1995, figures VIII and IX show he finally chose in favor of a virtual globe for the stars. But in discussions he revealed that he still has not fully made up his mind.

195. An improved version of Figure X in Couprie 1995, by kind permission of the author; cf. also Copurie 1998.

## Chapter Five
## Technology as Politics: The Origins of Greek Philosophy in Its Sociopolitical Context

1. Lloyd 1979, esp. pp. 242–269.

2. Cf. Burkert 1985, pp. 90ff; McEwen 1993, pp. 53 and 56.

3. Starr 1992, p. 59, on the aristocrats' role in the creation and design of the temple.

4. Hermann Kienast suggested to me that perhaps the patrons were the temple priests themselves. Even if this were so, the argument would not be affected. The priests, probably part of the aristocracy themselves, would have been motivated in a likewise fashion to promote their own interests, and those interests, like all others in positions of advantage, were to maintain the status quo.

5. Coulton 1977, pp. 20–21.

6. Coulton 1977, p. 21.

7. In just the same sense Gagarin 1986, pp. 145–146, reached the conclusion that written legislation established without a doubt the authority of the polis over its inhabitants. Cf. chapter 2, above.

8. Herodotus 2.180.

9. Coulton 1977, p. 22.

10. Herodotus 5.62.

11. Pryce 1928, pp.38ff: one inscription reads *basileus kroisos anethēke*; echoed also by Herodotus 1, 92.

12. Aristotle, *Politics*, 1313b21–24. Cf. also Young 1980, ch. 3.

13. Polyainos, *Stratagems,* on Phalaris, cf. 5.1.1, on Theron cf. 6.5.1. Polyainos is the military writer of the second century CE.

14. Coulton 1977, p. 163, n.45.

15. Plutarch, "Life of Themistocles," 22.

16. Plutarch, "Life of Pericles," 14. Cf. also Plato, *Gorgias*, 503ff, and esp. 514ff where Pericles and Themistocles are identified by name and connected with building projects.

17. Cf. the excellent and detailed study in Krämer 1959.

18. The *locus classicus* is *Meno* 93c–94e.

19. We must certainly leave open that Socrates might well regard Themistocles, Pericles, and the rest *not* to be virtuous, as the argument seems to go in the *Gorgias*, and so the failure to teach virtue to their children was first of all a failure to become virtuous themselves. But, clearly, the whole argument plays off the ambiguity that on the one hand *aretē* has a traditional meaning for the Athenians, and Themistocles and Pericles must be included within that classification, and yet, according to the new view of it promoted by Socratic *elenchus*, they apparently seem to fall short.

20. Homer, *Iliad*, II.

21. Homer, *Iliad*, VI.145–149. Cf. also Sourvinou-Inwood 1983, p. 84 for an illuminating discussion of this passage.

22. Cf. Plato, *Symposium*, 175Cff., when Socrates responds to Agathon.

23. Plato, *Apology*, 38a.

24. Cf. Vernant 1982, pp. 22–37. Cf. also Mylonas 1957, and Austin and Vidal-Naquet 1977, pp. 36–47.

25. The status of the *wanax* as presented in the Homeric epic is delineated clearly in *Iliad* II, 195–206. There what we may call the "divine right of kings" is announced. Greatest is the god-supported king, a relation fostered in heaven. The king gains his honor from Zeus. It is Zeus who loves the king and it is this approval that grants the king his excellence and worth. It is Agamemnon who is given the title *[w]anax andron*, "king of men."

26. The dating has been much debated. Excavations have suggested that the palace was burned down around 1200 BCE but recent finds suggest that the town kept growing for at least a quarter or as much as a half-century. This might suggest that the fall of the central palace preceded the fall of Mycenae as such. In any case, by c. 1100 at the lat-

est, signs of devastating depopulation are apparent. Whether the cause that preceded this devastation was the Dorian invasion from the north, terrible drought or related climactic adversities, or some combination has been the subject of considerable debate. Deciding the issue of the proximate causes of the fall of the central palace/Mycenae has no special bearing on the present argument.

27. Cf. Snodgrass 1980, pp. 27, 35–36, 43; Coldstream 1977, ch. 2; Desborough 1972, pp. 18–35; Murray 1980, pp. 38–68; Grant 1987, pp. 2, 5, 7.

28. Cf. Snodgrass 1980, p. 40, referring to Thucydides' testimony; cf. also Murray 1980, pp. 65ff.

29. Cf. Vernant 1982, p. 45: "With the disappearance of the *wanax* who by superhuman power had unified and given order to the diverse groups that made up the kingdom, new problems emerged. How was order to arise out of discord between rival groups and the clash of conflicting prerogatives and functions?"

30. Cf. Snodgrass 1980, pp. 40ff; Boardman 1980, pp. 23–34, and pp. 111–161; Austin and Vidal-Naquet 1977, pp. 61–69; Murray 1980, pp. 100–119.

31. Snodgrass 1980, pp. 102ff. Concerning the influx of metallurgical techniques, cf. pp. 49–56. Cf. also Austin and Vidal-Naquet on the hoplites, pp. 207–209, 337–339; Cf. also Burkert, 1992, pp. 6, 11–12.

32. Cf. Snodgrass 1980, pp. 103ff; Murray 1980, pp. 120–131.

33. Snodgrass 1980, p. 107.

34. Vernant 1965, pp. 64–65.

35. Vernant 1965, p. 60.

36. Vernant 1965, p. 61.

37. Ehrenberg 1937.

38. Vernant 1965, p. 61.

39. Vernant 1965, p. 62.

40. Vernant 1965, p. 63.

41. Vernant 1965, p. 63.

42. Cf. the standard treatment by Andrewes 1956; Ure 1922; Nilsson 1936; Mosse 1969; and the short survey in White 1955; Cf. also Murray 1980, pp. 132–152; Starr 1986, pp. 80–86; Austin and Vidal-Naquet 1977, pp. 210–212, 217–219.

43. Aristotle, *Politics*, 1310b12–15, also 1305a8. Cf. also Plato, *Republic*, 565dff.

44. The Cypselidae of Corinth are often pointed to as a particularly egregious example.

45. This point is emphasized by Aristotle, *Physics*, 1311a3ff, several times, that the aim of tyranny is wealth in contrast to monarchy whose aim is honor. Aristotle's analysis of monarchy (1285b3–34) envisages the earliest ones in terms of a benefactor to the people who provides in the form of arts or arms. The earliest monarchs turned out to be those who organized the people into a community or procured land for them, and thus became kings of voluntary subjects, and their power was *inherited* by their descendent (1285b8–10). In ancient times, says Aristotle, the power of the monarchs extended continuously to all things whatsoever, in city and country, as well as foreign parts (1285b13–15). As time went on these monarchs relinquished or had taken from them these privileges. In some cases only the privilege of making communal sacrifices was still extended to them (1285b15–16). What Aristotle emphasized was that the earliest monarchies, however precisely they arose, were in his terms *legal* in the sense that authority was exercised over consenting subjects and perpetuated through lineage. For it was through his ancestry that the hereditary king had inherited his excellence that entitled him to the right to authority.

In contrast, Aristotle identifies the rise of tyranny with the challenge against the notables (*gnorimoi*, 1310b10–15). The tyrant was chosen from the people to be their protector against the notables in order to prevent them from being injured (1310b10–12). An examination of "history" as Aristotle understood it reveals that almost all tyrants had been demagogues who gained the favor of the people by their accusations of the aristocracy in power (1310b14–17). The rise of tyranny was marked by two central features: (1) the tyrannies were generally *illegal,* that is, without the consent of those subjected to the exercise of authority, and (2) although some tyrannies succeeded in passing the "right" to authority through inheritance, such as the Cypselidae of Corinth and the Peisistradae of Athens, the ascent of the tyrant was facilitated by rejecting or suspending the supposition that human excellence must be genealogically inherited.

46. This has been the conventional wisdom. Cf. Andrewes 1956, p. 14: "[T]he tyrants represent a revolution against the aristocracy."

47. Cf. Snodgrass 1980, pp. 39–40; cf. also Starr 1986, p. 70.

48. Cf. chapter 2 above; cf. also Snodgrass 1980, pp. 52–54.

49. Cf. the important work by dePolignac 1984 on the development of the sanctuaries and the birth of the Greek polis. For the

development of the non-urban sanctuaries such as Samos, Didyma, and Ephesus, cf. pp. 40–70.

50. Snodgrass 1980, p. 37.

51. Snodgrass 1980, p. 38. Consider contemporary Israel for comparable "arguments."

52. Herodotus 1. 67–68.

53. Herodotus 5. 67.

54. Snodgrass 1980, p. 39.

55. Cf. Aristotle, *Politics*, 1305a15ff, and 1310b20.

56. Cf. Cook 1982, pp. 211ff., who paints a picture of great competition for land all along the west coast of Asia Minor. While Samos, Lesbos, and Chios farmed tracts of land on the mainland across from them, cities such as Miletus annexed the islands across from them, in addition to the many colonies, especially on the Black Sea.

57. Herodotus 1. 15–43. Alyattes inherited from Sadyattes the war with Miletus which, according to Herodotus I.21, he terminated after five years with a lasting treaty after he was tricked by the tyrant Thrasyboulos into believing the food supplies were plentiful.

58. Plutarch*, Life of Pericles*, 14.

59. Starr 1992, p. 43.

60. Homer, *Odyssey* 18.120.

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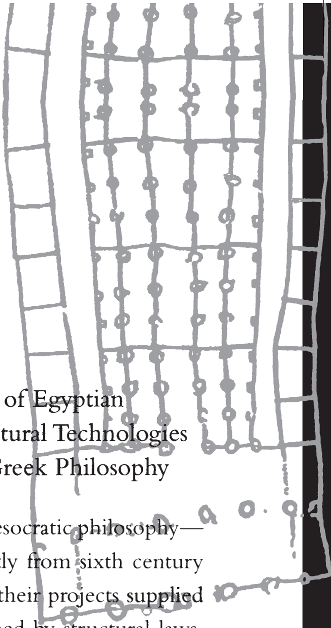
PHILOSOPHY

Robert Hahn

# Anaximander and the Architects

## The Contributions of Egyptian and Greek Architectural Technologies to the Origins of Greek Philosophy



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**Robert Hahn** is Associate Professor of Philosophy at Southern Illinois University at Carbondale. He is the author of *Formal Deductive Logic, Fifth Edition; Conduct and Constraints: Testing the Limits of the 'Harm Principle';* and *Kant's Newtonian Revolution in Philosophy.*

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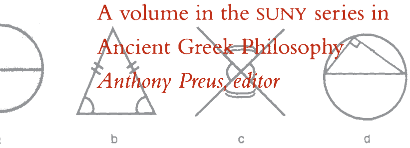


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