

Dumbarton Oaks Studies
XXXVI

SIEGECRAFT

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Two Tenth-Century Instructional Manuals
by “Heron of Byzantium”

Denis F. Sullivan

Dumbarton Oaks Research Library and Collection
Washington, D.C.

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Washington, D.C.
Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Siegecraft : two tenth-century instructional manuals / by "Heron of Byzantium"; [edited by] Denis F. Sullivan.

p. cm. — (Dumbarton Oaks studies ; 36)

Includes bibliographical references and index.

ISBN 0-88402-270-6

1. Siege warfare—Byzantine Empire—Early works to 1800. I. Sullivan, Denis F. II. Heron, of Byzantium. III. Series.

UG443 .S54 2000

355.4'4—dc21

99-052629

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Foreword

The texts commonly called the *Parangelmata Poliorcetica* and the *Geodesia* are products of tenth-century Byzantium; internal references indicate that they were created to assist in the construction and measurement of devices for the Byzantine offensive against Arab cities. The author of these works is anonymous, although he is often referred to as “Heron of Byzantium.” His texts are in large part compilations and interpretations of earlier works on siegecraft, particularly those by Apollodorus of Damascus (1st–2nd century A.D.) and Heron of Alexandria (1st century A.D.). However, the generally static nature of methods of fortification and references by tenth-century historians and in military manuals suggest that some of the machines described in the earlier works still had practical application centuries later. Nevertheless, a few of the devices are apparently included for their historical interest (e.g., Hegetor’s ram, the largest known from antiquity) and perhaps for their novelty (e.g., an inflatable leather ladder).

The manuals are in the tradition of didactic handbooks stretching back to the fourth-century B.C. work by Aeneas Tacticus, *On Defense of Fortified Positions*, and including a number of other tenth-century Byzantine texts that have been the subject of recent scholarly attention. The texts presented here in critical editions based on the archetype manuscript, Vaticanus graecus 1605, are notable for the author’s particular interest in effective methods of conveying technical information. He specifically formulates and subsequently employs a method of exposition in which concern with levels of vocabulary, order of presentation, depth of explication, use of “situated” examples for geometrical problems (he explains, “they learn pottery on the pot”), and realistic illustration set him apart from his predecessors. He also shows a degree of concern for the safety and motivation of troops not found in his sources. While by no means an error-free technical writer, the so-called Heron of Byzantium offers a distinctly new approach to technical pedagogy in the tradition of didactic military handbooks.

Foreword

It is a pleasure to extend my thanks to the many colleagues who have shared their expertise and to two institutions that furnished assistance during the preparation of these texts. Eric McGeer first suggested the project to me and was helpful at many points. George T. Dennis, Nicolas Oikonomides, and Alice-Mary Talbot offered early and continuing support. A sabbatical granted by the University of Maryland and a fellowship awarded by Dumbarton Oaks (1991–92) provided σχολή, excellent library facilities and a warmly collegial atmosphere for which I am most grateful. At various points I have consulted, with great benefit, Alexander Alexakis, Robert Farber, Stamatina McGrath, John Nesbitt, and Gabriele and Helmut Sieg. I am particularly grateful to Lee Sherry for reading through the penultimate version of the Greek text with me and to Jonathan Bardill for help with the realia of the Hippodrome. The anonymous readers provided a number of perceptive suggestions; I am most indebted to reader “B” for detailed comments. I am deeply grateful to the Biblioteca Apostolica Vaticana for permission to reproduce the forty-two illustrations from Vaticanus graecus 1605; I am also grateful to the Bibliothèque nationale de France and the Österreichische Nationalbibliothek for permission to reproduce illustrations from Parisinus supplementus graecus 607 and Vindobonensis phil. gr. 120, respectively. I have also benefited from the assistance of the staff of the publications office at Dumbarton Oaks, and particularly from the expertise of Frances Kianka, Karen Rasmussen, and Glenn Ruby.

The book is dedicated to the memory of my parents, Denis F. and Helen R. (Girard) Sullivan.

Dumbarton Oaks and
the University of Maryland,
March 1999

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Texts and Translations of “Heron of Byzantium”

Barocius

Heronis Mechanici liber de machinis bellicis necnon liber de geodesia a Francisco Barocio . . . (Venice, 1572) (a Latin translation of the *Parangelmata* and the *Geodesia* with annotations and illustrations, based on ms. Bononiensis Universitatis 1497)

Martin

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Rochas D’Aiglun

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Schneider

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Vincent

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Wescher

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Apollod.

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Archim. *Circ.*

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Archim. *Sph. Cyl.*

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Arist. *Top.*

Aristotle, *Topica*, ed. W. D. Ross, *Aristotelis topica et sophistici elenchi* (Oxford, 1958; repr. 1970), 1–189

Ath. Mech.

Athenaeus Mechanicus, Περὶ μηχανημάτων, ed. C. Wescher, *Poliorcétique des grecs* (Paris, 1867), 3–40

Biton

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De cer.

De caerimoniis aulae byzantinae, ed. J. J. Reiske, 2 vols. (Bonn, 1829–30)

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Nicom., *Ar.*

Nicomachus of Gerasa, *Introductio arithmetica*, ed. R. Hoche (Leipzig, 1866)

Nik. Chon., *Hist.*

Niketas Choniates, *Historia*, ed. J. L. Van Dieten (Berlin–New York, 1975)

Nikephoros Ouranos

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- Pl. *Grg.*
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- Pl. *Soph.*
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RE

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REB

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Introduction

Vaticanus graecus 1605, a richly illustrated manuscript dated on palaeographical grounds to the eleventh century, contains just two treatises — instructional manuals on the fabrication of siege machines and on the use of a dioptra (a kind of surveyor's theodolite) with applied geometry, ostensibly to estimate the required sizes of the machines — generally referred to as the *Parangelmata Poliorcetica* and the *Geodesia*. K. K. Müller first showed that the unedited Vaticanus was the archetype of the tradition of these texts,¹ which had been edited previously from the sixteenth-century Bononiensis Universitatis 1497 or its descendants.² In his monograph *La tradition du texte d'Héron de Byzance*, Alphonse Dain elaborated on Müller's demonstration and provided an exhaustive study of the tradition.³ The two treatises represent the work of an anonymous tenth-century Byzantine compiler and commentator, who updated and supplemented for his contemporaries the works of classical poliorcetic authors,⁴ particularly Apollodorus of Damascus (1st–2nd cen-

¹ Müller's argument rests on the observations that all manuscripts of the tradition exhibit significant lacunae, noticed by earlier editors, which correspond to the loss of folios in the Vaticanus, and incorrect sequences of text that can be shown to result from a faulty rebinding of the Vaticanus. Müller concludes ("Handschriftliches," 456): "Klar ist nun, dass alle Hss., welche die eben verzeichneten Lücken und die oben dargestellte Unordnung im Texte zeigen, ohne Ausnahme direkt oder indirekt auf den Vat. 1605 zurückgehen." Müller also provides a list of the readings in the Vaticanus that differ from the editions of Wescher and Vincent, based in part on his own observations and in greater part those of A. Mau.

² See the editions and translations by Barocius, Martin, Schneider, and Wescher of the *Parangelmata*, and Vincent of the *Geodesia* listed in the bibliography; for the stemma see Dain, *Tradition*, 155.

³ Dain concludes (*Tradition*, 42) on the archetype value of the Vaticanus: "On sait aussi que le Vaticanus 1605 présentait dans la *Poliorcétique*, comme dans la *Géodésie*, des lacunes dues à la chute de folios; ces mêmes lacunes se retrouvent dans tous nos manuscrits, et comme elles correspondent à des fins ou à des débuts de folios du Vaticanus 1605, il en résulte que la parenté avec ce manuscrit est amplement démontrée."

⁴ For the classical and Byzantine poliorcetic works and manuscripts, see Dain "Stratégistes," *passim*, and H. Hunger, "Kriegswissenschaft" in *Die hochsprachliche profane Literatur der Byzantiner* (Munich, 1978), II:321–40.

ture A.D.),⁵ but also Athenaeus Mechanicus (1st century B.C.), Biton, and Philo Mechanicus (perhaps 3rd century B.C.), as well as Heron of Alexandria's (1st century A.D.) *Dioptra*. He also presents the material with a new pedagogical approach to both text and illustration which he indicates is more appropriate for his "nonengineering" audience. As noted below, he does so with a mix of both insightful and at times inaccurate interpretations.

The Author, The So-called Heron of Byzantium

The rubrication of the Vaticanus was never carried out, leaving the headpiece of the manuscript blank as well as initial letters of paragraphs and the space left between the two treatises. Thus the name of the author and the titles of the works were never recorded. A later hand (Dain, *Tradition*, 13, suggests 14th–15th century) added the words Ἡρων(ος) (sic) – προοίμ(ιον) to the headpiece,⁶ perhaps deriving the name Heron from the Byzantine author's use of Heron of Alexandria and the fact that the Alexandrian was the best known of the classical writers on technology. The Byzantine commentator nowhere mentions his own name and makes no claim to be Heron of Alexandria; there is no indication that the author of the addition to the headpiece had any external evidence for the name. The numerous Byzantine references in the texts, however, show that the author was not Heron of Alexandria. Various epithets have also been added to distinguish the Byzantine from his predecessor(s), thus Hero tertius, Heron the Younger and Heron of Byzantium.⁷ The last is now the more common designation and, while again nowhere mentioned in the text, is at least appropriately descriptive. In the *Geodesia* the commentator employs a number of examples set in the Hippodrome of Constantinople⁸ and says (*Geodesia* 11:36–38) that he engraved longitude and latitude lines "in the . . . admirable imperial terrace balcony (?) . . . near Boukoleon's" (ἐν τῷ ἀξιογάστῳ βασιλικῷ . . . παρακυπτηρίῳ (ἐν) τοῖς Βουκολέοντος), that is in an area

⁵ For the view that the *Poliorctica* attributed to Apollodorus was not actually authored by him and includes significant later additions, see Blyth, "Apollodorus," passim.

⁶ See fig. A.

⁷ For discussion of the epithets see Dain, *Tradition*, 15.

⁸ This was noted by Martin, 285–304; see also Vincent, 352–53.

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overlooking the shore of the Sea of Marmara. Whether he was born in Constantinople we have no indication, but that he worked there and chose examples for an audience familiar with the city is clear. Most modern scholars refer to the author as the Anonymus Byzantinus, which is the factually correct position. In the interest of clarity of identification and given numerous other “anonymi byzantini,” I have chosen to retain “Heron of Byzantium”⁹ on the title page, but generally refer to him as the Anon. Byz.

Date of Composition

A date for the composition of the two texts was proposed with detailed argumentation and a critique of earlier proposals, by T. H. Martin (267–75) who noted that the Anon. Byz. in the *Geodesia* (11:73–76, 86–87) says: “For Regulus, with the onward movement of the time since Ptolemy, is found to have now 101/2 degrees in Leo; and the Bright Star of the Hyades 202/3 degrees in Taurus” (Ὅ γὰρ Βασιλίσκος, σὺν τῷ ἐπικινήματι τῶν ἀπὸ τοῦ Πτολεμαίου χρόνων, ἰ΄ Ὀμοίρας ἐπὶ τοῦ Λέοντος νῦν εὐρίσκεται ἐπέχων· καὶ ὁ Λαμπρὸς τῶν Ἰάδων ἐπὶ τοῦ Ταύρου κ΄ β΄), and “For Arcturus now is at the fifth degree in Libra, with the onward movement” (Ὅ γὰρ Ἀρκτοῦρος νῦν ε΄ μοίραν τοῦ Ζυγοῦ, σὺν τῷ ἐπικινήματι, ἐπέχει). Martin proposed that the Anon. Byz. had not observed the stars himself but had taken the values for the same stars given in the *Star Catalog* in Ptolemy’s *Almagest* and simply added Ptolemy’s precession rate of 1 degree per century to get the values he gives. The exactly 8 degree difference in all three cases between the Anon. Byz. and Ptolemy would thus place the composition of the texts eight centuries after the date of Ptolemy’s work or, as Martin (275) concluded, “Héron le Jeune écrivait donc cet ouvrage en l’an 938 ou à

⁹ See Dain, *Tradition*, passim; Wescher, 197: Ἀωνόμου ἤτοι Ἡρώου Βυζαντίου. Cf. K. Tittel, *RE* 8 (1913), cols. 1074–80: “Heron von Byzanz (auch H. der Jüngere genannt).” Heath, *History*, II:318–19 tentatively suggested that the author might be Nikephoros Patrikios, the teacher of geometry appointed by Constantine VII, based on his possible connection with editions of Heron of Alexandria’s *Geometria* and *Stereometrika* and the fact that he was a contemporary of “Heron of Byzantium.” There appears to be no further basis for the suggestion, and the Anon. Byz.’s mathematical errors would seem to militate against it. For Nikephoros Patrikios see P. Lemerle, *Byzantine Humanism* (Canberra, 1986), 307.

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peu près.” Martin also argued (275–77) that the Anon. Byz.’s reference to the use of his work against the “cities of Agar” (*Parangelmata* 58) best fits the period of Romanos I Lekapenos and Constantine Porphyrogenetos.¹⁰

Alphonse Dain accepted Martin’s basic conclusion, while reasonably cautioning about acceptance of the precise year, and added that the Byzantine was using a corpus of classical poliorcetic authors that did not exist in collected form until the beginning of the tenth century.¹¹ Dain also noted the Anon. Byz.’s references in the *Parangelmata* to siege devices that reflect tenth-century practice, particularly the handheld tube for projecting Greek fire (49:20: μετὰ στρεπτῶν ἐγχειριδίων πυροβόλων, depicted on folio 36r).¹² One might add the Anon. Byz.’s comparison of a base of a scout-ladder to an “uncial” *eta* (27:15, 28:4: ἦτα λιτόν), a use of λιτός not found before the late 9th century;¹³ also his characterization of the enemy with the rare adjective θεόλεστος (58:9) which accords well with a mid-tenth-century date, as discussed below.

Method of Presentation

The Anon. Byz. indicates in his opening paragraph his concerns with the presentation method (which he calls the καθολικὴ τεχνολογία) of his classical sources, naming specifically (in an apparently corrupt passage that, given the authors he actually uses, may have originally contained additional names) Apollodorus of Damascus, Athenaeus Mechanicus, and Biton. He thus had access to a manuscript of the poliorcetic corpus that, as Dain has shown, was from the branch of the tradition now most closely preserved in a fragmentary state in the six-

¹⁰ Schneider (85) suggested a possible connection with the encyclopedic work commissioned by Constantine Porphyrogenetos and concludes that this would insure the anonymity of the author. There is no evidence for such a connection and for doubts see Dain, *Tradition*, 16–17.

¹¹ Dain, *Tradition*, 16 and n. 3

¹² *Ibid.*, 16 and n. 2. It is worth adding that Leo VI (*Taktika* XIX:57) also mentions the devices, which he describes as “recently fabricated” (παρὰ τῆς ἡμῶν βασιλείας ἄρτι κατασκευασμένα).

¹³ For this usage and date see Atsalos, *Terminologie*, 106ff. I am grateful to Alice–Mary Talbot for bringing this reference to my attention.

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teenth-century Vindobonensis phil. gr. 120, and paralleled by another branch found with more complete text in Paris. suppl. gr. 607 dated to the second quarter of the tenth century.¹⁴ The Byzantine commentator indicates that to understand his sources one would need one of the “engineers” (μηχανικοί) who composed them. He states that his objective is to make it possible for siege machines to be constructed “by anyone” (παρὰ τῶν τυχόντων), phrasing derived from Apollodorus; he subsequently describes his potential users as military leaders seeking to besiege Arab cities (*Parangelmata* 58). He also indicates (*Geodesia* 6) that he has added examples, particularly mathematical examples, for “beginners” (οἱ εἰσαγόμενοι), referring “the more accomplished” (οἱ ἐντελέστεροι) to the works of Archimedes and Heron. He thus writes for a mixed audience, but with the express intent of making his sources’ engineering descriptions accessible to nonengineers. He also provides generic statements of his own methodological approach to achieve this objective, an approach that incorporates a new view of how to present technical material in a format that will lead to practical results. The anonymous author illustrates his general statements with numerous specific examples in both treatises.

Textual Changes

The Anon. Byz. describes the core of his method of textual presentation at two points in the *Parangelmata*: “Having clarified only the works of Apollodorus as it were in toto, with additional elaborations and secondary arguments, we have drawn our conclusions, finding and adding ourselves numerous concordant <items>. Everything we have collected here and there from the remaining <writers> is easy to know and apprehend truthfully, “axioms of common intuition” as Anthemios says, and capable of being comprehended from the problem alone and the illustration; they require no instruction or interpretation” (1:25–33); “all writing on siege warfare requires . . . sometimes also repetitions and reiterations and secondary arguments (ταυτολογιῶν καὶ ἐπαναλήψεων καὶ ἐπενθυμημάτων) for comprehension of the concepts and operations” (3:4–8). He also indicates (1:33–

¹⁴ Dain, *Tradition*, 19–20, following Wescher, xxxviii.

34) that he will use common diction (ιδιωτεία λέξεων) and simple style (ἀπλότητι λόγου), although this is clearly a *topos*.¹⁵

The rhetorical terminology (ἐπεργασίαι, ἐπενθυμήματα, ταυτολογίαί, and ἐπαναλήψεις) employed here may reflect an acquaintance, direct or more likely through handbooks, with the Hermogenic corpus.¹⁶ The precision with which the Anon. Byz. uses the technical terms, however, is uncertain; he is not writing a rhetorical piece but an instructional manual. Yet he is clearly attempting to give his method a consciously articulated framework unlike anything found in his sources. His reworkings and clarifications of these sources are varied in nature and at times helpful, in other cases obvious and pedantic. He sometimes changes aspects of the sequence of presentation in his sources: for example, at *Parangelmata* **13**:13–14 the Anon. Byz. mentions early in his description that excavating tortoises are wheeled, a fact mentioned by his source Apollodorus only at the end. He also inserts lengthy mathematical examples: for example, at *Parangelmata* chap. **38** he compares in detail the dimensions of two mobile siege towers with special emphasis on their proportional relationships and in chap. **51** adds dimensions for a mobile landing tube, again with emphasis on proportion. He frequently inserts similes in the *Parangelmata*, comparing the blade of a borer to a garden spade (**17**:12–13), the base of a scout-ladder to an uncial letter Η (**27**:15), clamping caps to pivot sockets (**22**:35–37), metal washers to clay pipes (**44**:24), and so on. Finally, he adds his own interpretations of technical issues, for example on the nature of a torsion system attached to a battering ram (**44**:18–20) and on a system for maintaining equilibrium between two yoked ships (**53**:33–34).

Two other methods of clarification deserve examination in greater detail. First, the Anon. Byz. frequently adds directional information: for example, at **5**:2–3 Apollodorus’ “rolling objects” (τὰ ἐπικυλιόμενα) become “objects being rolled down from above by the enemy” (τὰ ἄνωθεν ἀπὸ τῶν ἐναντίων ἐπικυλιόμενα); at **7**:2–3 to Apollodorus’ instruction

¹⁵ For the *topos* in the 10th century see R. Browning, “The Language of Byzantine Literature,” in S. Vryonis, ed., *The Past in Medieval and Modern Greek Culture* (Malibu, Calif., 1978), 103–33 (repr. in R. Browning, *History, Language and Literacy in the Byzantine World* [Northampton, 1989], XV), esp. 103–4 with citations of similar sentiments in Leo VI, *Taktika* and *De admin.*

¹⁶ On the rhetorical terminology see the related notes in the commentary.

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for besiegers to dig a defensive ditch the Anon. Byz. adds at the outset, “Beginning from below from the foot of the slope” (ἐκ γὰρ τῆς ὑπωρείας κάτωθεν ἀρχομένους); and at **16:10–11** the addition “from the outer facade” (ἀπὸ δὲ τῆς ἔξωθεν ὄψεως) indicates more precisely where a hole is to be drilled in a metal laminated jar. Second, the author provides logical explanations of statements made by his sources. For example, at **11:14–15**, drawing on Philo Mechanicus’ defensive tactic of burying empty jars over which troops can walk, but which siege machines cause to collapse, halting the machines, he adds the (obvious) explanation that it is the weight of the machines that causes the collapse (λίαν βαρυτάτοις οὔσι) and a specific mention that the jars break under the weight (ἐπι τῇ θραύσει καὶ ἐπιδόσει τῶν ὑποκειμένων κεραμίων). At **12:16–18** he adds to Philo’s description of inflatable leather ladders the explanation: “For when they are inflated and full of air <and> kept from deflating, they necessarily become upright, held firm for climbing by the air” (ἐμφυσωμένων γὰρ καὶ πνεύματος πληρουμένων τοῦ διαπνεῖν κωλυομένων, ἐξορθοῦσθαι αὐτὰς ἀνάγκη, ὑπὸ τοῦ πνεύματος ἀντεχομένων πρὸς τὴν ἀνάβασιν). At **13:10–11** to Apollodorus’ recommendation for the use of three, four, or five beams in constructing an excavating tortoise the Anon. Byz. adds, to explain the five-beam approach, “for thicker and more solid results” (διὰ τὸ πυκνότερον καὶ στερεώτερον τοῦ ἔργου). Again, at **39:6–7** he adds “so that the tower may be maintained steadfast in position when turbulent battle is joined” (ὅπως ἐπὶ τῇ συμβολῇ καὶ τῷ κλόνῳ τῆς μάχης ἀκλινήσῃ πρὸς τὴν στάσιν ὁ πύργος συντηρῆται) to explain the purpose of the underplate of the portable siege tower of Apollodorus. It is presumably such directional and explanatory insertions that the author characterizes as “additional elaborations and secondary arguments” (ἐπεργασίαι and ἐπενθυμήματα), which he believes will aid the reader’s comprehension.

The Anon. Byz.’s third named category, tautology, can be seen, for example, at **15:5**, “greasy and viscous” (λιπαρὸν καὶ κολλώδη); **39:2**, “even and level” (ὀμαλὸς καὶ ἰσοπέδιος); **53:5**, “well known and obvious” (εὐγνώστους . . . καὶ φανεράς). In each case he has added the second adjective to the text of his source. Tautology is combined with vocabulary change at **22:2**, “to shatter and break” (ρηγνύειν καὶ διασπᾶν) for “shake” (σεισαι) in Apollodorus, and at **44:10–11**, “being pulled up and falling” (ἐκσπῶνται . . . ἐκπίπτωσι) for Apollodorus’ “be dislodged” (ἐξάλλωνται).

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The Anon. Byz. also mentions in his methodological discussion (1:21–22) a concern that “the scientific terms are not familiar to the common speech” (καὶ ἀσυνήθη κοινοῖς τυγχάνει λόγοις τὰ τῶν ἐπιστημῶν ὀνόματα). While the phrase is taken directly from his source Apollodorus, the Anon. Byz. clearly shares his concern and makes numerous changes in the interest of clarity. In many cases these appear to involve substitutions of general terms or periphrases for technical or rarer ones, distinctions sometimes difficult to capture in translation: for example, “poles” for “vine-poles” (ξύλα for κάμακες) at **10:4**; “points” for “spikes” (ξίφη for στύρακες) at **10:14**; “openings” for “niches” (διάχωρα for ζωθήκαι) at **14:2**; “bindings” for “ties” (δεσμά for ἄμματα) at **56:12**; “blade . . . narrowed . . . in front” for “apex” (πέταλον . . . ἐπὶ τὸ ἔμπροσθεν . . . ἐστενωμένον for ὁ οὐραχός) at **17:10–12**; “these beams that come down” for “swipes” (ταῦτα . . . κατερχόμενα for τὰ κηλώνια) at **27:30–31**. Others may reflect contemporary usage: for example, σαθρότερα for ἀσθνεστάτους (**4:10**); λαός for ὄχλος (**10:1**); λακκίσματα for τέλματα (**11:7**); ὑποδήμασι for ἐνδρομίδες (**11:20**); ἀυλίσκον for σύριγξ (**16:13**); πέταλον for λεπίς (**17:10**); ἐπανάπτεισθαι for ἐρεθίζεσθαι (**19:24**).

Thus the Anon. Byz. explicitly states his own methodological approach to updating and clarifying the textual aspects of his classical sources and can be shown to apply the method extensively, adding explanations and simplifying vocabulary for nonengineering readers. These changes are noted in more detail in the commentary.

Changes in Illustrations

Even more interesting in terms of methodology is the Anon. Byz.’s description of his new approach to illustration of the devices described and their actual illustration in the archetype.¹⁷ In his introductory sentence to the *Parangelmata* the Anon. Byz. comments that poliorcetic

¹⁷ For an earlier version of this argument see the abstract of my paper “Technical Illustration and Neoplatonic Levels of Reality in Vaticanus Graecus 1605,” *Abstracts of the 19th Annual Byzantine Studies Conference, 4–7 November 1993* (Princeton, N.J.), 96–97, and my “Tenth Century Byzantine Offensive Siege Warfare: Instructional Prescriptions and Historical Practice,” *Byzantium at War (9th–12th c.)* (Athens, 1997), 179–200, esp. 198–99.

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concepts (νοήματα) are hard to grasp, that they are perhaps comprehensible by “‘ignorance’ alone” (τῇ ἀγνωσίᾳ μόνῃ), as they do not obtain clarity “from looking at the drawings” (ἀπ’ αὐτῆς τῆς τῶν σχημάτων θέας). Examples of the drawings in his sources which evoked this response are presumably contained in Vindonbonensis phil. gr. 120 and closely paralleled in Paris. suppl. gr. 607. The drawings in those manuscripts may be characterized as peculiar in their combination of ground plan and elevation in a single composition and in the addition of some depth to the elevations. Also various parts of the devices are sometimes presented and labeled individually to clarify their function, but with resulting loss of an indication of their relationship to the whole. In some illustrations reference letters are employed and cited in the text.¹⁸ In origin technical plans, by the tenth century they have become a strange hybrid.¹⁹ A number of these characteristics are visible in the drawings of the ram-tortoise of Hegetor reproduced in fig. B. The Anon. Byz. indicates (1:37–39) that to facilitate understanding he will not employ the method of drawing that he finds in his sources, but combine his improved verbal descriptions “with the drawings, giving these precise definition” (σὺν τοῖς σχήμασιν ἀκριβῶς διορισάμενοι), thus producing “an illustration . . . well defined” (σχηματισμὸς καλῶς διορισθεῖς).

The reading “ignorance” (ἀγνωσία), emended by previous editors²⁰ working from apographs, is also in the archetype and, I suggest, correct, employed here as used frequently in the sense “unknowing” employed by Pseudo-Dionysius. For example, *De mystica theologia* I:3: “into the darkness of unknowing in which one rejects all the perceptions of knowing” (εἰς τὸν γνόφον τῆς ἀγνωσίας . . . καθ’ ὃν ἀπομυεῖ πάσας τὰς γνωστικὰς ἀντιλήψεις), and II:1: “through unseeing and unknowing to see and know what is beyond seeing and knowing” (δι’ ἀβλεψίας καὶ ἀγνωσίας ἰδεῖν καὶ γινῶναι τὸ ὑπὲρ θέαν καὶ γινῶσιν). This “negative cognition,” a condition accomplished by the rejection of apprehension

¹⁸ See Wescher, xxiv.

¹⁹ The relationship, if any, between the drawings in the Paris manuscript and the original drawings of the classical poliorcetic authors is, of course, a very remote one; see Sackur, *Vitruv*, 19–21; Lendle, *Texte*, xx and n. 8; idem, *Schildkröten*, 122; and Marsden, *Treatises*, 62.

²⁰ ἐννοία (in the margin of London add. 15276, 16th century); εὐγνωσία (Martin); διαγνωσία (Wescher); εὐγνωμοσύνη (for ἀγνωσία μόνῃ) (Schneider).

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through the senses, results from ἀφαίρεσις, variously translated “removal,” “abstraction,” or “denial,” which involves ascent to universals by removal of particulars (ibid., II:1: ἀπὸ τῶν ἐσχάτων ἐπὶ τὰ ἀρχικώτατα τὰς ἐπαναβάσεις ποιούμενοι, τὰ πάντα ἀφαιροῦμεν, ἵνα ἀπερικαλύπτως γνῶμεν ἐκείνην τὴν ἀγνωσίαν).²¹ On this reading the source drawings the Anon. Byz. criticizes are conceptualized by him as at a level of reality beyond normal sense perception and thus beyond the capability of anyone but trained engineers to comprehend. A comparison of the illustrations of the ram-tortoise of Hegetor found in Vindobonensis phil. gr. 120 and Paris. suppl. gr. 607 with the same tortoise as illustrated in the Vaticanus conveys this difference clearly (fig. B). The choice of the term may represent an example of a major principle of Byzantine rhetoric, that “obscurity” is a virtue of style, a principle connected with “the sense of the mystical, the understanding of the relation between the universal and the particular.”²²

The Anon. Byz.’s contrast of “drawing” vs. “illustration” (σχῆμα/ σχηματισμός) (the latter term occurs twice in the introductory paragraph, once in the conclusion to the *Parangelmata*, and again in a scholion in the *Geodesia*) is also paralleled in Neoplatonism. Simplicius’ use of the contrast has been characterized by C. Luna as representing “le rapport de participation entre la figure transcendante et l’objet sensible.”²³ At *In Aristotelis Categorias commentarium* 8:271:26, for example, Simplicius, following Archytas, comments that Aristotle’s fourth category, “quality” (ποιότης), resides not ἐν σχήματι . . . ἀλλ’ ἐν σχηματισμῷ; earlier (8:21:14–19), commenting on the distinction between Socrates and a picture (εἰκόν) of Socrates, he defines the latter as an “illustration of colors” (χρωμάτων οὐσα σχηματισμός), which he later (8:21:18–19) calls

²¹ For discussion of the concept see S. Lees, *The Negative Language of the Dionysian School of Mystical Theology* (Salzburg, 1983), esp. I:140–41: “Ps. Dionysius effectively proposes a new method of apprehension which is appropriate to the incomprehensibility of its object — a method whose alienation from natural processes of sensual and intellectual perception is imaged in, rather than properly described by, the paradoxical construction of the individual words.” For the *via negativa* in mathematics, see J. Whittaker, “Neopythagoreanism and Negative Theology,” *Symbolae Osloenses* 44 (1969), 109–125.

²² See Kustas, *Rhetoric*, 12.

²³ I. Hadot et al., *Simplicius: Commentaire sur les Catégories*, fasc. III (Leiden, 1990), 148.

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a “surface σχῆμα” (σχήματος ἐπιπολαίου); he also says (8:261:24–26) regarding “quality” that “it must be comprehended according to the σχηματισμός of the surface” (ληπτέον . . . κατὰ τὸν τῆς ἐπιφανείας ποιὸν σχηματισμόν). “Quality” here is used in the sense of Aristotle, *Categoriae* 10a11: “the external form of each thing” (ἡ περὶ ἕκαστον ὑπάρχουσα μορφή). These and other passages in Simplicius, then, specifically use the σχῆμα/σχηματισμός contrast to distinguish between the generalized concept and the individual reality the senses perceive. This is particularly clear in the definition in the passage cited above of the σχηματισμός as a “surface σχῆμα” (ἐπιπόλαιον σχῆμα).²⁴

Finally, the term “give definition to” (διορίζεσθαι), used to describe how a σχῆμα will become a σχηματισμός, is paralleled by references in Neoplatonic authors. At *In Aristotelis Categoriae commentarium* 8:217:27–29, for example, Simplicius has τὰ ἀσώματα εἶδη, διὰ τούτων ἐμφαίνεται, ἀλλ’ ἄτακτα καὶ ἀδιόριστα πάντα τὰ τοιαῦτα φέρεται παρ’ αὐτοῖς, and at 8:261:21–23 where the category of ποιότης is described: διότι ἐπιπολῆς καὶ οἶον ἔξωθεν ἐπ’ ἐσχάτῳ τοῦ σώματος συνίσταται. πολυμερὲς δέ ἐστιν καὶ πολυειδὲς τὸ γένος τοῦτο. καὶ ἔστιν ἐν αὐτῷ σχῆμα μὲν τὸ ὑπὸ τινὸς ἢ τινῶν ὄρων περιεχόμενον.²⁵ Thus “to give definition or definiteness” (ὄρος) to a σχῆμα is used in some Neoplatonists of giving it the externalities or particulars of quality.²⁶ Here then the Anon. Byz. seems to complete,

²⁴ Similar uses of σχηματισμός alone as a representation of superficial appearance can also be found in Pseudo-Dionysius (e.g., *Epistula* 9:2: προσέτι δὲ καὶ τῶν νοητῶν ἅμα καὶ νοερῶν ἀγγέλων οἱ θεοειδεῖς διάκοσμοι ποικίλαις μορφαῖς διαγράφονται καὶ πολυειδέσι, καὶ ἐμπυρίοις σχηματισμοῖς) and in Macarii Aegyptii *Epistolae* (PG 34:413C): ἕκαστος ἡμῶν νοητὴ συκῆ, παρ’ ἧς ὁ κύριος τὸν ἔνδον καρπὸν ἐπιζητεῖ, καὶ οὐ τὸν ἐκ φύλλων ἐπικείμενον σχηματισμόν, among others. The distinction can also be seen at different levels of reality in Plotinus, *Ennead* VI:7:14: ἐν ἐνὶ σχήματι νοῦ οἶον περιγραφῆ ἔχων περιγραφᾶς ἐντὸς καὶ σχηματισμοῦς ἀπὸ ἐντὸς . . .

²⁵ See also Simplicius, *In Aristotelis Physica commentaria* 9:537:15–16: τὸ δέ ἐστι πέρας καὶ ὄρος τοῦ ἀόριστου διαστήματος ὀριστικόν τε καὶ περιεκτικόν, καὶ τοῦτο μὲν ἐστὶ τὸ εἶδος (“there is boundary and a defining limit which makes the indefinite extension definite and embraces it, and this is form”); trans. R. Sorabji, “Simplicius: Prime Matter as Extension,” in I. Hadot, *Simplicius: Sa vie, son oeuvre, sa survie* (Berlin, 1987), 148–65, specifically 163. Cf. Simplicius, *In Aristotelis Categoriae commentarium* 8:28:4–6: τὸ δὲ κοινὸν καὶ ἀόριστον . . . ὅπερ μετὰ τοῦ διορισμοῦ ληφθὲν τὸ κοινὸν ἰδιωθὲν καὶ ἀπομερισθὲν παρίστησιν.

²⁶ For discussion see Sorabji (as in previous note) and cf. Aristotle, *Analytica Posteriora* 81b7–8: τῶν γὰρ καθ’ ἕκαστον ἡ ἀίσθησις (“sense perception apprehends particulars”).

by choice of terminology, his conceptualization of his new approach to technical illustration as at the level of what the senses see, the surface appearance, while suggesting that the approach found in his sources is at a higher level of abstraction.

The validity of this interpretation is strengthened not only by the nature of the illustrations in Vat. gr. 1605, but also by overt references in the texts. The Anon. Byz. (3:9–14) cites Porphyry (ὁ πολὺς ἐν σοφίᾳ), on Plotinus (ὁ μέγας), that Plotinus was “concerned only with the concept and the things. For he knew that reality is tripartite: words, concepts, and things” (μόνου τοῦ νοῦ καὶ τῶν πραγμάτων ἐχόμενος. Τριττὰ γὰρ τὰ ὄντα ἡπίστατο, ἔν τε φωναῖς νοήμασί τε καὶ πράγμασι). The phrase “and the things” (καὶ τῶν πραγμάτων) is not in any manuscript of the cited passage of Porphyry’s *Vita Plotini* and has apparently been added here by the Anon. Byz. to the citation. The view of reality as tripartite is found in the sixth-century Neoplatonists Olympiodorus and Elias.²⁷ The sentence also seemingly reflects what S. Gersch²⁸ has described in another context as the extensive Neoplatonic controversy about the subject of Aristotle’s *Categories*,²⁹ whether it classifies “words” (φωναί), “things” (πράγματα), or “concepts” (νοήματα), and which as Gersch notes was commented on by Porphyry and is, among extant works, best documented in Simplicius. The Anon. Byz. next argues (3:18–22) that one who errs about “things,” his worst-case scenario, falls into Plato’s “double ignorance,” ἄγνοια (“knowing that one knows and not understanding that one is ignorant”). Thus the Anon. Byz. cites Plato and Neoplatonists by name, deliberately supplements the text of the *Vita Plotini* to mark a contrast between “concepts” and “things” (νοήματα and πράγματα), shows a specific, if unsophisticated,³⁰ knowledge of Neoplatonic epistemology,

²⁷ See Olymp. Phil., *Proll.* 18:25–27, and Elias Phil., *In Cat.* 129:9–11.

²⁸ *From Iamblichus to Eriugena* (Leiden, 1978), 96 n. 76.

²⁹ On the centrality of Aristotle’s *Categories* and Porphyry’s commentary thereon in Byzantine philosophical education, as well as the growing interest in Neoplatonism in the late 9th and 10th centuries before the “renaissance” associated with M. Psellos, see R. Browning, *The Byzantine Empire*, rev. ed. (Washington, D.C., 1992), 138, and Lemerle, *Byzantine Humanism*, 251–55.

³⁰ The Anon. Byz. appears to use two levels of reality, that of sense perception and a level above, which he uses of both νοήματα and mathematical objects ἐν φαντασίᾳ, levels that are often distinguished by some Neoplatonists (see, e.g., the distinction between φαντασία and διάνοια in Syrianus below, note 31). Gersch, however, observes

and evinces a clear preference for the sensible realities (πράγματα).

In the *Geodesia* (6:29, 37) the Anon. Byz. describes geometrical figures as existing “in concept and reality . . . in reality and imagination” (νοήσει τε καὶ αἰσθήσει . . . αἰσθήσει τε καὶ φαντασίᾳ), reflecting again dual levels of reality, here most similar to those found especially in Proclus.³¹ A number of the geometrical figures in Vat. gr. 1605 are notable in their realistic qualities, for example, a circle depicted with rocks and bushes on its perimeter (chap. 7), a human figure with a rope measuring a circle (chap. 7), and a cistern depicted with individual bricks visible and filled with water to illustrate calculation of the volume of a rectangular solid (chap. 9).³² Finally, the Anon. Byz.’s stated purpose for his modified verbal descriptions in the introductory passage of the *Geodesia* (1:28–30) exemplifies as well his approach to illustration: “to bring down to a low and more sensible level the height of their theory concerning these concepts” (καὶ τὸ ὑψηλὸν τῆς περὶ τὰ νοήματα θεωρίας ἐπὶ τὸ ταπεινὸν καὶ αἰσθητικώτερον κατενεγκεῖν).³³

(94 n. 61, as above in note 29) that for convenience of argument the Neoplatonists “sometimes speak simply of two levels: sensible (immanent) Forms and psychic Forms (concepts).”

³¹ See esp. Proclus, *In primum Euclidis librum commentarius* 51:14–21 and G. Morrow, *Proclus, A Commentary on the First Book of Euclid’s Elements* (Princeton, N. J., 1970) 41 n. 5 on the idea of φαντασία as a form of νόησις. See also the interesting passage in Syrianus (*In Metaphysica commentaria* 6:98:26ff (on 1078a14) on the place of φαντασία in practical construction: ὁμοίως καὶ ὁ μηχανικὸς τὴν ὕλην σχηματίζων ἐπ’ ἀνάγει πᾶσαν ἑαυτοῦ τὴν ποίησιν ἐπὶ τὰ ἄυλα σχήματα καὶ ἐν φαντασίᾳ μὲν διαστατῶς, ἐν διανοίᾳ δὲ ἀμερῶς τὴν ὑπόστασιν ἔχοντα. G. Watson, *Phantasia in Classical Thought* (Galway, 1988), 119 comments on this passage: “When someone is making something, for instance, he shapes his matter in accordance with an immaterial blueprint (schemata), which exists unextended in the mind and in extended fashion in phantasia.” The Anon. Byz., I suggest, is arguing for the educational value of descending still one level of reality further down.

³² One other passage provides evidence of the author’s interest in the effect of realistic representation. In a recommendation in the *Parangelmata* (52:5–10) not found in his classical sources he suggests for the doors of a *sambuca* (a tubelike troop carrier): Αἱ δὲ τοῦ αὐτοῦ στομίου θύραι ἔξωθεν καταπληκτικαὶ διὰ γλυφῆς ἐκφανοῦς καὶ πολυχρώμου γραφῆς σὺν τῷ ἐμπροσθίῳ μέρει τοῦ αὐλοῦ γινέσθωσαν, δράκοντος ἢ λέοντος πυροφόρον ἐπιφερόμεναι προτομήν εἰς κατάπληξιν καὶ φόβον τῶν ἐναντιῶν προσερχομένων.

³³ It is worth noting that even the traditional geometrical drawings found in the *Geodesia* (used to show measurement of the height of a wall, distances between points in the horizontal plain, and so on) are given a concrete quality by examples in the text

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I suggest, then, that the approach to poliorcetic, and to a lesser extent geometric, illustration in Vat. gr. 1605 is consciously articulated in his text by the Anon. Byz.³⁴ Reversing the Neoplatonic³⁵ idea of ascent from what the senses perceive to the νοήματα, he replaces “schematic” drawings, conceived of as objects “in thought” and “in imagination,” with “sensibles” to achieve a practical educational purpose, and specifically describes the process, “give definition to, particularize” (ἀκριβῶς διορίζεσθαι) the σχήματα. Such use of depictions of finished devices was perhaps initially more acceptable in an “original” Byzantine compilation, one not bound by the dictates of the classical tradition. Therefore, the so-called Heron of Byzantium would appear to be the first adapter of realistic representation to the poliorcetic genre, with a new pedagogical vision, both textual and especially pictorial, of how his contemporaries could best learn to create physical objects. He brings to the genre a method that is quite new, even though one flawed by misinterpretations and errors.

The Errors

Otto Lendle comments that the Anon. Byz. interpreted the work of Apollodorus “nach seinem (manchmal überzeugenden, gelegentlich in

set in the Hippodrome of Constantinople, e.g. (*Geodesia* 2:15–16), ὡς [τοῦ] ἀπὸ τοῦ (ἐπὶ) ἐδάφους τῶν θυρῶν ὑποτεθέντος B πρὸς τὸ ἐπὶ μέρους τινὸς τοῦ τεθρίπτου σημειωθέν A (“from <point> B assumed at the bottom of the doors to point A noted on some part of the quadriga”).

³⁴ The illustrations in Vat. gr. 1605 are, of course, at least once removed from those that accompanied the Anon. Byz.’s original work. Given the specific verbal description he provides of his approach to illustration and the conservatism of illustrators, it seems reasonable to assume that many of the main characteristics of the illustrations in the Vaticanus follow those in the autograph. Whether the illustrator of the Vaticanus introduced additional innovations is uncertain.

³⁵ Other indications of Neoplatonic influence in the Anon. Byz. include his characterization in the *Geodesia* (7:47–48) of the radius of a circle as ἐν ἀρχῇ . . . ἀπ’ ἀρχῆς . . . ἐπ’ ἀρχήν, an image widely found in Neoplatonic authors, especially Plotinus (e.g. *Ennead* V.1:10), Pseudo-Dionysius (e.g., *De divinis nominibus* 5) and Proclus (e.g., *In primum Euclidis librum commentarius* 155:6–8: Ἄλλ’ ὡς μὲν τῆς διαστάσεως ἀρχὴ τῶν γραμμῶν τῷ “ἀφ’ οὗ” σημαίνεται, ὡς δὲ μέσον τῆς περιφερείας τῷ “πρὸς οὗ”), and his reference to Pythagorean views of the cube as representing “harmony” (*Geodesia* 8:13–15).

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die Irre gehenden) Verständnis.”³⁶ In addition to occasional and serious misinterpretations of the sources, the Byzantine author also makes some errors in mathematics and in his “astronomical” methodology. In the first category, for example, W. Sackur observed that the Anon. Byz. misinterprets the method of diminishing the size of each upward story of the portable siege tower of Diades as one based on area rather than on width (*Parangelmata* 30), with resulting errors in his description of Apollodorus’ tower.³⁷ In the second category the Byzantine author (*Geodesia* 8) incorrectly computes the surface area of a cone, apparently due to his misinterpretation of Archimedes. Finally, T. H. Martin (394–95) has noted, among a number of problems, that the Byzantine “paraît avoir confondu, de même que les anciens astrologues, les *ascensions droites* avec les *ascensions obliques*, et avoir confondu aussi *déclinaisons* avec les *latitudes*.” Such errors are noted in the commentary. Sackur’s general characterization (*Vitruv*, 106) seems not unfair: “Der Anonymus Byzantinus ist ein sehr gewissenhafter Arbeiter . . . aber ein eigentlich technisches Denken . . . dürfen wir bei ihm nicht erwarten.”

The Tenth-Century Context

The tenth century witnessed a flowering of interest in codifying and transmitting methods of warfare. This interest occurred in large part as a response to the Arab threat and the accompanying shift from a defensive to an offensive posture on the part of the Byzantine state.³⁸ One primary focus of the shift was Crete, lost in about 826 and the objective of numerous expeditions, including the failed expedition in 949 (the preparations for which are described in detail in *De cerimoniis*, 669ff) and the final success of Nikephoros Phokas in 960–961. Other foci of the tenth-century offensive included Muslim territory in Cilicia and northern Syria. The taking of walled cities and fortifications was a significant part of such expeditions (e.g., Melitene, Edessa, Chandax, and Aleppo). The list of military manuals compiled during the period includes Leo VI’s *Taktika* (ca. 905), *De obsidione toleranda* (after 924), the

³⁶ Lendle, *Texte*, xx.

³⁷ Sackur, *Vitruv*, 106.

³⁸ See E. McGeer, “Infantry vs. Cavalry: The Byzantine Response,” *REB* 46 (1988), 135.

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Sylloge tacticorum (ca. 950), the *Praecepta militaria* attributed to Nikephoros Phokas (ca. 965), the *De re militari* (ca. 975), *De velitatione* (ca. 975), and the *Taktika* of Nikephoros Ouranos (ca. 1000).³⁹ Most of these take a comprehensive view of warfare; some, however, present siege warfare as one facet of the whole enterprise. Thus chap. 15 of Leo's *Taktika* is entitled *Περὶ πολιορκίας πόλεων*, chap. 21 of the *De velitatione* *Περὶ πολιορκίας κάστρου*, chap. 21 of the *De re militari* *Περὶ πολιορκίας*, and chap. 65 of Ouranos' *Taktika* *Περὶ καστροπολέμου*.

The degree of realism in these texts has been the subject of recent scholarly interest.⁴⁰ Among the issues considered have been the extent to which they simply preserve classical sources and with what intent, how useful the classical techniques were in the tenth-century context, and how much specifically contemporary material they contain. Gilbert Dagron has suggested three criteria for judging relative modernity: (1) the attention paid to the evolution of military technology, although this, as Dagron notes, admittedly saw no radical transformation; (2) the description of the enemy, for example, ethnic nature, social composition, and military methods; and (3) the composition and structure of the Byzantine army, including recruitment, administrative and political status, and the appearance of a military caste.⁴¹ Of Dagron's latter two criteria there is little evidence in the Anon. Byz. With regard to the enemy the Anon. Byz., in explaining the purpose of his work, says that if they (i.e., the Byzantines) construct siege machines by the methods he describes, military leaders "will easily capture cities, especially those of Agar and themselves suffer nothing fatal from the God-damned enemy" (*εὐχερῶς τὰς τῆς Ἄγαρ μάλιστα λήψονται πόλεις, αὐτοὶ μὴθὲν ἀνήκεστον ὑπὸ τῶν θεολέστων ἐχθρῶν πάσχοντες*, chap. 58). It is thus specifically against Arab cities that he sees his work as being employed. The use of the adjective *θεόλεστος* may also be indicative. The word occurs three times in *De cerimoniis* (514:5 and 9, 651:15) in the phrase "against God-damned Crete" (*κατὰ τῆς θεολέστου Κρήτης*) with regard

³⁹ For a review of the military manuals see Dain, "Stratégistes," *passim*. Individual articles on most of these are contained in the *ODB*.

⁴⁰ See T. G. Kolias, "The *Taktika* of Leo VI the Wise and the Arabs," *Graeco-Arabica* 3 (1984), 129–35; G. Dagron, *Traité*, 139–60; E. McGeer, "Infantry," 136; and McGeer "Tradition," 129–40.

⁴¹ Dagron, *Traité*, 142.

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to the expedition of 911 under Himerios, and in the Δημηγορία Κωνσταντίνου βασιλέως πρὸς τοὺς τῆς ἀνατολῆς στρατηγούς 5:13: κατὰ τῶν χωρῶν καὶ κάστρων τῆς θεολέστου Ταρσοῦ.⁴² Theophanes (ὑπὸ τοῦ θεολέστου αὐτῶν ἔθνους) also uses the term in connection with Arabs.⁴³ The adjective, as well as the specific reference to Arab cities, thus sets the intent of the treatise in line with Byzantine objectives of the 940s and 950s.

Concerning the third criterion, the Anon. Byz. says nothing on issues of military recruitment, or the political and administrative nature of the army and makes only brief, but interesting, mention of the army's officer class. At the end of the *Parangelmata*, in the sentence whose conclusion was quoted above, he begins: "If army commanders carefully complete with logic and continuous diligence these siege machines, which have been selectively compiled for description and illustration, and always contemplate divine justice, being honored for their fairness and reverence, and strengthened and guarded by the powerful hand and cooperation and alliance of the God-crowned and Christ-loving emperors of Rome" ((Τ)αῦτα τοίνυν τὰ πρὸς ἀναγραφὴν καὶ σχηματισμὸν κατ' ἐκλογὴν συνταχθέντα πολιορκητήρια μηχανήματα οἱ τῶν στρατευμάτων ἐξάρχοντες μετὰ λόγου καὶ συνεχοῦς μελέτης ἐπιμελῶς κατεργαζόμενοι, τὴν θεῖαν διὰ παντὸς ἐνοπτριζόμενοι δίκην, ἐπὶ δικαιοσύνη καὶ εὐσεβείᾳ κεκοσμημένοι καὶ τῇ κραταιᾷ χειρὶ συνεργεῖα τε καὶ συμμαχίᾳ τῶν θεοστέπων καὶ φιλοχρίστων ἀνάκτων Ῥώμης ἐνδυναμούμεοί τε καὶ φρουρούμενοι). It is thus the military leaders whom he sees as employing his treatise and they are characterized as closely associated with the emperors. Earlier in the treatise, immediately following the introductory material, he says (chap. 4): "The most competent military commander, kept safe by Providence above because of his piety, and obedient to the command and judgment and good counsel of our most divine emperors" ((Τ)ὸν ὑπὸ τῆς ἄνω προνοίας ἐπ' εὐσεβείᾳ συντηρούμενον στρατηγικώτατον ἄρχοντα, τῇ κελεύσει καὶ γνώμῃ καὶ εὐβουλίᾳ τῶν θειοτάτων αὐτοκρατόρων ὑπέικοντα), again linking military leaders with the emperors and here, perhaps rhetorically, but nev-

⁴² Ed. R. Vári, "Zum historischen Exzerptenwerke des Konstantinos Porphyrogenetos," *Byzantinische Zeitschrift* 17 (1908), 75–85.

⁴³ *Chronographia* 499:21 (ed. C. de Boor; repr. Hildesheim, 1963).

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ertheless explicitly, describing them as highly skilled. General officers are thus portrayed as close to the emperors and learned in their profession.

On Dagron's first criterion the treatise presents issues of greater complexity. The Anon. Byz. specifically indicates that he is working from classical sources, and thus his work is obviously heavily derivative; he also tells us that he will add material. The author's description of the classical material should, however, be set in the context of his modernization of the method of presentation discussed above, by which both textually and pictorially he seeks to make the classical material more accessible. Further, as Dagron notes, evolution of military technology was not radical, a point that can be substantiated by specific references in tenth-century texts. The historians provide one source of information about siege techniques. John Kaminiates, for example, describes the Arabs besieging Thessalonica in 904 as using siege towers on paired ships, a technique described by the Anon. Byz. in *Parangelmata* 53, following Athenaeus Mechanicus. Whether Kaminiates' description is actually tenth-century, however, has been questioned.⁴⁴ Leo the Deacon (*Historiae* II:7) describes Nikephoros Phokas' siege of Chandax (961) as involving a battering ram and methods of undermining walls also described by the Anon. Byz. (*Parangelmata* chaps. 22–23 and 13–14); but Leo's account has been shown to be heavily dependent on a siege description in Agathias (*Historiae* 1:10).⁴⁵ Anna Comnena (e.g., *Alexiad* XI:1:6–7; XIII:2:3, 3:9) describes portable siege towers, tortoises for filling and excavating, undermining walls, ram-tortoises, and even the importance of the dioptra in correctly constructing siege engines, all items discussed by the Anon. Byz. Yet even here literary influence cannot be completely ruled out.

More helpful are inventory lists and comments of practitioners. In the list of items prepared for the expedition against Crete in 949 the *De cerimoniis* lists a "wooden tower," ξυλόπυργος (670:10–11), "tortoises,"

⁴⁴ A. P. Kazhdan, "Some Questions Addressed to the Scholars Who Believe in the Authenticity of Kaminiates' Capture of Thessalonica," *Byzantinische Zeitschrift* 71 (1978), 301–14. For an opposing view, however, see J. Frendo, "The Miracles of St. Demetrius and the Capture of Thessaloniki," *Byzantinoslavica* 58 (1997), 205–24.

⁴⁵ C. B. Hase, *Leonis Diaconi Historiae libri X* (Bonn, 1828), 419, note 25: 19.

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χελῶνας (670:11), and “ram-tortoises” εἰς . . . τὰς χελῶνας κριοί (670:13, 671:4–5, 673:1), all classical devices covered in considerable detail by the Anon. Byz. Nikephoros Ouranos (*Taktika* 65:22) comments: “The men of old, in their pursuit of siege warfare, constructed many devices such as battering rams, wooden towers, scaling ladders with various features, tortoises, and all kinds of other things which our generation can hardly imagine. It has, however, tried all these devices and found that out of all of them, the most effective way, one which the enemy cannot match, is undermining the foundations, all the more so if one does so with careful scrutiny and method, and has the accompanying and extremely helpful protection of *laisai* (mantlets)” (Οἱ μὲν γὰρ παλαιοὶ ἔχοντες τὴν σπουδὴν εἰς καστροπόλεμον ἐποίουν καὶ μηχανήματα πολλὰ οἷον κριοὺς καὶ πύργους ξυλίνους καὶ σκάλας ἐχούσας ἄλλα καὶ ἄλλα ἰδιώματα, καὶ χελῶνας καὶ ἄλλα περισσότερα ἄπερ ἡ ἡμετέρα γενεὰ οὐδὲ ἰδεῖν ἴσχυσε· πλὴν ἀπεπείρασε τὰυτα πάντα καὶ εὗρεν ἐκ πάντων τούτων ἐπιτηδειότερον καὶ ἀναπάντητον τοῖς ἐχθροῖς τὸ διὰ τῶν θεμελίων ὄρυγμα, ἂν ἄρα καὶ μετὰ διακρίσεως καὶ τάξεως ποιήσῃ τις αὐτό, ἔχων συνακολουθοῦσαν καὶ βοηθοῦσαν πολὺ καὶ τὴν σκέπην τῶν λαισῶν).⁴⁶ Ouranos thus indicates that his generation has tested various classical siege devices (rams, <mobile> wooden towers, ladders, and tortoises) and found that undermining walls using *laisai* (light weight shelters plaited from branches, a contemporary Byzantine technology) is the most effective technique. The Anon. Byz. includes all of the classical devices mentioned by Ouranos, including methods of undermining walls as well as the contemporary *laisai*. Ouranos’ detailed description (65:18–21) of the undermining of walls using an “excavate, prop, and burn” method has a number of similarities with the description of the Anon. Byz. (*Parangelmata* 13–14). Finally, in the eleventh century, Kekaumenos comments: “Since those wondrous men who have written treatises on war machines constructed rams and engines and many other tools by which they captured cities, I say also to you to construct one of these engines, but if you can to also invent something new. For this is more worthy of praise.” (Ἐπεὶ δὲ οἱ θαυμαστοὶ ἄνδρες ἐκεῖνοι οἱ περὶ μηχανημάτων στρατηγικῶν συγγραψάμενοι ἐμηχανήσαντο κριοὺς καὶ μηχανικὰ καὶ ἄλλα πολλὰ ὄργανα ἐν οἷς εἶλον πόλεις, λέγω σοι κάγω

⁴⁶ Trans. McGeer, “Tradition,” 161–63.

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μηχανήσασθαι μηχανήν τινα ἐξ αὐτῶν, εἰ δὲ δύνασαι, καὶ καινόν τι ἐπινοήσασθαι. Τοῦτο γὰρ μᾶλλον ἐπαίνου ἐστὶν ἄξιον).⁴⁷ Thus classical devices were still considered of value, but even more praiseworthy was innovation, based in part on a knowledge of classical sources.

The Anon. Byz. also indicates (*Parangelmata* 1:27–28) that he will add related information to his paraphrase of Apollodorus, πλείστα καὶ αὐτοὶ σύμφωνα προσευρόντες καὶ παραθέμενοι. Much of this material is drawn from other classical sources, but some is clearly contemporary. Dain has listed among them the wheeled ladder with drop-bridge (chap. 46), excavating tortoise with drop-bridge (chap. 47), various remarks on ladders and bridges, including the handheld στρεπτόν for shooting Greek fire (chap. 49), and improvements to Athenaeus Mechanicus' landing tube (chap. 52).⁴⁸ Eric McGeer has noted references to the clearly contemporary *laisai* (chaps. 9, 17, 47).⁴⁹ A number of other briefer references not found in the classical sources are scattered through the text, for example, the use of urine for cracking heated stones (chap. 16), τοξοβολίστραι (chap. 15), alternate bases for a scout-ladder (chaps. 27, 28), and silk (νήματα σηρικὰ) for torsion springs (chap. 44). The illustrations in Vat. gr. 1605 also provide evidence of contemporary practice. The *laisai* are depicted on folios 8r and 35r, the στρεπτόν on folio 36r, and the human figures are shown in contemporary military dress, felt hats, tunics, and boots (καμελαύκια, καβάδια, and ὑποδήματα).

Thus while the *Parangelmata* and the *Geodesia* are clearly heavily derived from classical sources, the potential practical value that the Anon. Byz. ascribes to them (to “capture cities, especially those of Agar”) is verified by other tenth-century theory and practice for at least some of the devices and methods described. Classical devices were still tried and used in the tenth century: the *De cerimoniais* indicates the use of siege towers, tortoises, and rams; Ouranos indicates trial of numerous such devices, together with innovation, as does the advice of Kekaumenos.

⁴⁷ Ed. G. G. Litavrin, *Sovety i rasskazy Kekavmena* (Moscow, 1972), 148:23–28.

⁴⁸ Dain, *Tradition*, 16 n. 2. Dain's comment, “A dire vrai, dans le texte relatif au πυροβόλον, Héron ne dit rien qui ne se trouve dans Apollodore: ce qui est nouveau c'est la vignette,” is questionable. The Anon. Byz. says μετὰ στρεπτῶν ἐγχειριδίων πυροβόλων (*Parangelmata* 49:20), a description not in his source and clearly referring to a middle Byzantine device.

⁴⁹ McGeer, “Tradition,” 136.

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The Anon. Byz.'s new method of presentation is intended to improve his readers' understanding of classical engineering descriptions, while his inclusion of tenth-century material indicates his awareness of innovation. The contemporary value of such a book is also attested by the remark of Constantine VII, in describing for his son the items to be included in the imperial baggage: "books on mechanics, including siege machinery and the production of missiles and other information relevant to the enterprise, that is to say wars and sieges" (βιβλία μηχανικά, ἐλεπόλεις ἔχοντα, καὶ βελοποιικὰ καὶ ἕτερα ἀρμόδια τῇ ὑποθέσει ἡγουν πρὸς πολέμους καὶ καστρομαχίας).⁵⁰ At the same time, however, it is clear that some items in the text would seem to have only antiquarian interest (e.g., the ram of Hegetor, the largest from antiquity) and others, although derived from the classical sources, are of questionable value (e.g., the inflatable leather ladder from Philo Mechanicus and the raft of Apollodorus). The utility of the works is also compromised by the Anon. Byz.'s errors.

Editorial Principles

K. K. Müller's and Alphonse Dain's studies of the manuscript tradition of the two texts associated with "Heron of Byzantium" convincingly established the archetype value of Vat. gr. 1605; it led Dain to recommend a new edition based on it. Dain also noted the sound state of the text in the Vaticanus and proposed that there were few intermediaries between the original and this copy. His description of Vat. gr. 1605, coupled with those of Müller and Cyrus Gianelli, leaves little to be added.⁵¹ The manuscript is parchment, 258 mm x 210 mm, with 58

⁵⁰ Trans. J. Haldon, *Constantine Porphyrogenitus, Three Treatises on Imperial Military Expeditions* (Vienna, 1990), 106, lines 196–98.

⁵¹ C. Gianelli, *Codices Vaticani Graeci: Codices, 1485–1683* (Vatican City, 1950), 260–62. Gianelli noted that the final folio contains the designation "AND," taken to be the bookmark of Charles of Anjou, suggesting that Vat. gr. 1605 may have been among the books given to the pope after the battle of Beneventum; see also P. Canart, "Le livre grec en Italie méridionale sous les règnes Normand et Souabe: aspects matériels et sociaux," *Scrittura e civiltà* 2 (1978), 103–62, esp. 149 n. 113, and N. Wilson, *Scholars of Byzantium* (Baltimore, Md., 1983), 214. However, A. G. Bagliani, "La provenienza 'angioina' dei codici greci della biblioteca de Bonifacio VIII," *Italia medioevale e umanistica* 26 (1983), 27–69, esp. 43–44, has argued persuasively that the abbreviation is not to be connected with Charles of Anjou and "sembra essere destinata a rimanere misteriosa e sibillina." I am grateful to an anonymous reader for this last reference.

extant folios, and notably contains only the two treatises of “Heron of Byzantium.” Dain’s suggestion of a mid-eleventh-century date (Müller and Gianelli say only 11th century without further specification) might be questioned in light of the recent tendency to place manuscripts earlier.⁵² Of the origin of the manuscript and the reasons for the lack of rubrication we know nothing. Later interlinear annotations⁵³ on folios 4r–v, 6v, 7r, 53v, and 54r and their subsequent erasure have obscured some accents and the upper portion of some letters. The first folio is reproduced in fig. A.

The edition, then, is based on the archetype, Vat. gr. 1605, previously not used in any edition.⁵⁴ Where I have recorded the conjectures of the previous editors, I have, for the sake of clarity, generally also included the related reading of the apograph as they report it; in some instances a negative entry appeared sufficient. In those instances where I have preferred the reading of an apograph to the Vaticanus, the reading of the apograph is also derived from the printed edition. I have not noted in the apparatus editorial conjectures or errors and omissions in the apographs for which the archetype provides correct readings. I have supplied in angle brackets and generally without further notice initial paragraph letters omitted in the Vaticanus⁵⁵ due to lack of rubrication. As the text has generally been cited from Wescher’s and Vincent’s editions, their page numbers are noted in the margin preceded by “Wes” and “Vin”; I have not attempted to retain their line breaks. I have allowed the scribe’s inconsistency in employing elision and *nu* movable

⁵² For such earlier dating generally, see, e.g., Dagron, *Traité*, 14–15.

⁵³ On their likely nature see Gianelli (as above, note 51), 262.

⁵⁴ I note the following errors in Müller’s recorded readings of V, using his listing by Wescher’s and Vincent’s page and line numbers: 217, 2 *επαλιφθέντα*: *επαλιφέντα* V || 252, 9 *υπεμβαίνονται*: *υπεμβαίνοντα* V || 264, 15 *σχάριον*: *σχαρίον* V || 264, 17 *διάμετρα*: *διάμετροι* V || 348, 17 *όλίγον δια γραμμάτων*: *όλίγων* (–ων per compendium) *διαγραμμάτων* V || 350, 5 *πρός τε γεωδεσίαν και: προς τε γεωδεσίαν τε και* V || 350, 6 *τε om.*: *τε* V || 350, 8 *εὐ κρινῆσαι*: *εὐκρινῆσαι* V || 350, 10 *εὐλήπτως*: *εὐλήπτων* (–ων per compendium) V || 376, 14 *ἄπερ: ἄσπερ* V || 378, 6 *οἱ δ’:* *ὁ ιδ’* V || 390, 6 *βολιβοῦν*: *μολιβοῦν* V ||. In one instance Müller has not recorded a significant difference, i.e., Vincent 396, 8 has *λβ’* (i.e., “32”); Müller makes no comment, while V has *λβ’ β’* (i.e., “32 2/3”), on which see the related note in the commentary.

⁵⁵ *Parangelmata* 1, 4, 11, 13–20, 22, 24, 25, 27–29, 39^{1, 17}, 42, 43, 45–50, 52, 53, 55–58 and *Geodesia* 1, 3–7, 8^{1, 60, 85, 96, 105}, 9^{1, 46}, 10^{1, 19}, 11.

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to remain as it appears in the manuscript. Errors resulting from iotacism, homophonic confusions, dittography (e.g., πέταλλον for πέταλον in all but one instance), and incorrect accents and breathings are not recorded unless a different meaning is possible.

Measurement Units in the Text

For specific numerical measurements of length the author uses the δάκτυλος (“finger”), πούς (“foot”), πῆχυς (“cubit”), and ὀργυά (“fathom”); the στάδιον (“stade”) is employed in a scholion. He also mentions the παλαιστή (“palm”) and the σπιθαμή (“span”). Proportional relationships between units of measure are explicitly stated in *Parangelmata* **18** and **38** and in the scholion at *Geodesia* **6**. The author uses $16 \text{ δάκτυλοι} = 1 \text{ πούς}$, $11\frac{1}{2} \text{ πόδες} = 1 \text{ πῆχυς}$, $4 \text{ πήχεις} = 1 \text{ ὀργυά}$; also the $\text{παλαιστή} = 4 \text{ δάκτυλοι}$, the $\text{σπιθαμή} = 12 \text{ δάκτυλοι}$. The author compares (*Parangelmata* **38**) for commensurability different siege towers built using πήχεις and πόδες respectively as the units of measure. In *Geodesia* **9** in measuring the volume of the cistern of Aspar, he makes a comparison between the cubic πῆχυς and ὀργυά a major part of his presentation. An analogous situation exists for units of liquid volume, the κεράμιον and the κάδος. Given the integral nature of the specific measurement units to the text and the differences between, for example, the Byzantine *pous* and the English “foot,” it has seemed best to simply transliterate the measurement terms. The units of length have the following values; for in-depth treatment see Schilbach, *Metrologie*.

1 δάκτυλος, pl. δάκτυλοι (<i>daktylos, daktyloi</i>)	1.95 cm
1 παλαιστή, pl. παλαισταί (<i>palaiste, palaistai</i>)	7.8 cm
1 σπιθαμή, pl. σπιθαμαί (<i>spithame, spithamai</i>)	23.4 cm
1 πούς, pl. πόδες (<i>pous, podes</i>)	31.23 cm
1 πῆχυς, pl. πήχεις (<i>pechys, pecheis</i>)	46.8 cm
1 ὀργυά, pl. ὀργυαί (<i>orgya, orgyai</i>)	1.87 m

Sigla: Variar lectiones et coniecturae

V	Vaticanus graecus 1605, XI
B	Bononiensis Universitatis 1497, XVI
P	Parisinus supplementus graecus 817, XIX
< >	addenda
< . . . >	lacuna
[]	delenda
Dain	Dain, <i>Tradition</i>
Mango	Mango, "Palace"
Mar	T. H. Martin
Marsden	Marsden, <i>Treatises</i>
Sch	R. Schneider
Vin	A. J. H. Vincent
Wes	C. Wescher

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Vaticanus graecus 1605, a richly illustrated manuscript dated on palaeographical grounds to the eleventh century, contains just two treatises — instructional manuals on the fabrication of siege machines and on the use of a dioptra (a kind of surveyor's theodolite) with applied geometry, ostensibly to estimate the required sizes of the machines — generally referred to as the *Parangelmata Poliorcetica* and the *Geodesia*. K. K. Müller first showed that the unedited Vaticanus was the archetype of the tradition of these texts,¹ which had been edited previously from the sixteenth-century Bononiensis Universitatis 1497 or its descendants.² In his monograph *La tradition du texte d'Héron de Byzance*, Alphonse Dain elaborated on Müller's demonstration and provided an exhaustive study of the tradition.³ The two treatises represent the work of an anonymous tenth-century Byzantine compiler and commentator, who updated and supplemented for his contemporaries the works of classical poliorcetic authors,⁴ particularly Apollodorus of Damascus (1st–2nd cen-

¹ Müller's argument rests on the observations that all manuscripts of the tradition exhibit significant lacunae, noticed by earlier editors, which correspond to the loss of folios in the Vaticanus, and incorrect sequences of text that can be shown to result from a faulty rebinding of the Vaticanus. Müller concludes ("Handschriftliches," 456): "Klar ist nun, dass alle Hss., welche die eben verzeichneten Lücken und die oben dargestellte Unordnung im Texte zeigen, ohne Ausnahme direkt oder indirekt auf den Vat. 1605 zurückgehen." Müller also provides a list of the readings in the Vaticanus that differ from the editions of Wescher and Vincent, based in part on his own observations and in greater part those of A. Mau.

² See the editions and translations by Barocius, Martin, Schneider, and Wescher of the *Parangelmata*, and Vincent of the *Geodesia* listed in the bibliography; for the stemma see Dain, *Tradition*, 155.

³ Dain concludes (*Tradition*, 42) on the archetype value of the Vaticanus: "On sait aussi que le Vaticanus 1605 présentait dans la *Poliorcétique*, comme dans la *Géodésie*, des lacunes dues à la chute de folios; ces mêmes lacunes se retrouvent dans tous nos manuscrits, et comme elles correspondent à des fins ou à des débuts de folios du Vaticanus 1605, il en résulte que la parenté avec ce manuscrit est amplement démontrée."

⁴ For the classical and Byzantine poliorcetic works and manuscripts, see Dain "Stratégistes," *passim*, and H. Hunger, "Kriegswissenschaft" in *Die hochsprachliche profane Literatur der Byzantiner* (Munich, 1978), II:321–40.

ture A.D.),⁵ but also Athenaeus Mechanicus (1st century B.C.), Biton, and Philo Mechanicus (perhaps 3rd century B.C.), as well as Heron of Alexandria's (1st century A.D.) *Dioptra*. He also presents the material with a new pedagogical approach to both text and illustration which he indicates is more appropriate for his "nonengineering" audience. As noted below, he does so with a mix of both insightful and at times inaccurate interpretations.

The Author, The So-called Heron of Byzantium

The rubrication of the Vaticanus was never carried out, leaving the headpiece of the manuscript blank as well as initial letters of paragraphs and the space left between the two treatises. Thus the name of the author and the titles of the works were never recorded. A later hand (Dain, *Tradition*, 13, suggests 14th–15th century) added the words Ἡρων(ος) (sic) – προοίμ(ιον) to the headpiece,⁶ perhaps deriving the name Heron from the Byzantine author's use of Heron of Alexandria and the fact that the Alexandrian was the best known of the classical writers on technology. The Byzantine commentator nowhere mentions his own name and makes no claim to be Heron of Alexandria; there is no indication that the author of the addition to the headpiece had any external evidence for the name. The numerous Byzantine references in the texts, however, show that the author was not Heron of Alexandria. Various epithets have also been added to distinguish the Byzantine from his predecessor(s), thus Hero tertius, Heron the Younger and Heron of Byzantium.⁷ The last is now the more common designation and, while again nowhere mentioned in the text, is at least appropriately descriptive. In the *Geodesia* the commentator employs a number of examples set in the Hippodrome of Constantinople⁸ and says (*Geodesia* 11:36–38) that he engraved longitude and latitude lines "in the . . . admirable imperial terrace balcony (?) . . . near Boukoleon's" (ἐν τῷ ἀξιογάστῳ βασιλικῷ . . . παρακυπτηρίῳ (ἐν) τοῖς Βουκολέοντος), that is in an area

⁵ For the view that the *Poliorctica* attributed to Apollodorus was not actually authored by him and includes significant later additions, see Blyth, "Apollodorus," passim.

⁶ See fig. A.

⁷ For discussion of the epithets see Dain, *Tradition*, 15.

⁸ This was noted by Martin, 285–304; see also Vincent, 352–53.

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overlooking the shore of the Sea of Marmara. Whether he was born in Constantinople we have no indication, but that he worked there and chose examples for an audience familiar with the city is clear. Most modern scholars refer to the author as the Anonymus Byzantinus, which is the factually correct position. In the interest of clarity of identification and given numerous other “anonymi byzantini,” I have chosen to retain “Heron of Byzantium”⁹ on the title page, but generally refer to him as the Anon. Byz.

Date of Composition

A date for the composition of the two texts was proposed with detailed argumentation and a critique of earlier proposals, by T. H. Martin (267–75) who noted that the Anon. Byz. in the *Geodesia* (11:73–76, 86–87) says: “For Regulus, with the onward movement of the time since Ptolemy, is found to have now 101/2 degrees in Leo; and the Bright Star of the Hyades 202/3 degrees in Taurus” (Ὅ γὰρ Βασιλίσκος, σὺν τῷ ἐπικινήματι τῶν ἀπὸ τοῦ Πτολεμαίου χρόνων, ἰ΄ Ὀμοίρας ἐπὶ τοῦ Λέοντος νῦν εὐρίσκεται ἐπέχων· καὶ ὁ Λαμπρὸς τῶν Ἰάδων ἐπὶ τοῦ Ταύρου κ΄ β΄), and “For Arcturus now is at the fifth degree in Libra, with the onward movement” (Ὅ γὰρ Ἀρκτοῦρος νῦν ε΄ μοίραν τοῦ Ζυγοῦ, σὺν τῷ ἐπικινήματι, ἐπέχει). Martin proposed that the Anon. Byz. had not observed the stars himself but had taken the values for the same stars given in the *Star Catalog* in Ptolemy’s *Almagest* and simply added Ptolemy’s precession rate of 1 degree per century to get the values he gives. The exactly 8 degree difference in all three cases between the Anon. Byz. and Ptolemy would thus place the composition of the texts eight centuries after the date of Ptolemy’s work or, as Martin (275) concluded, “Héron le Jeune écrivait donc cet ouvrage en l’an 938 ou à

⁹ See Dain, *Tradition*, passim; Wescher, 197: Ἀωνόμου ἤτοι Ἡρώου Βυζαντίου. Cf. K. Tittel, *RE* 8 (1913), cols. 1074–80: “Heron von Byzanz (auch H. der Jüngere genannt).” Heath, *History*, II:318–19 tentatively suggested that the author might be Nikephoros Patrikios, the teacher of geometry appointed by Constantine VII, based on his possible connection with editions of Heron of Alexandria’s *Geometria* and *Stereometrika* and the fact that he was a contemporary of “Heron of Byzantium.” There appears to be no further basis for the suggestion, and the Anon. Byz.’s mathematical errors would seem to militate against it. For Nikephoros Patrikios see P. Lemerle, *Byzantine Humanism* (Canberra, 1986), 307.

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peu près.” Martin also argued (275–77) that the Anon. Byz.’s reference to the use of his work against the “cities of Agar” (*Parangelmata* 58) best fits the period of Romanos I Lekapenos and Constantine Porphyrogenetos.¹⁰

Alphonse Dain accepted Martin’s basic conclusion, while reasonably cautioning about acceptance of the precise year, and added that the Byzantine was using a corpus of classical poliorcetic authors that did not exist in collected form until the beginning of the tenth century.¹¹ Dain also noted the Anon. Byz.’s references in the *Parangelmata* to siege devices that reflect tenth-century practice, particularly the handheld tube for projecting Greek fire (49:20: μετὰ στρεπτῶν ἐγχειριδίων πυροβόλων, depicted on folio 36r).¹² One might add the Anon. Byz.’s comparison of a base of a scout-ladder to an “uncial” *eta* (27:15, 28:4: ἦτα λιτόν), a use of λιτός not found before the late 9th century;¹³ also his characterization of the enemy with the rare adjective θεόλεστος (58:9) which accords well with a mid-tenth-century date, as discussed below.

Method of Presentation

The Anon. Byz. indicates in his opening paragraph his concerns with the presentation method (which he calls the καθολικὴ τεχνολογία) of his classical sources, naming specifically (in an apparently corrupt passage that, given the authors he actually uses, may have originally contained additional names) Apollodorus of Damascus, Athenaeus Mechanicus, and Biton. He thus had access to a manuscript of the poliorcetic corpus that, as Dain has shown, was from the branch of the tradition now most closely preserved in a fragmentary state in the six-

¹⁰ Schneider (85) suggested a possible connection with the encyclopedic work commissioned by Constantine Porphyrogenetos and concludes that this would insure the anonymity of the author. There is no evidence for such a connection and for doubts see Dain, *Tradition*, 16–17.

¹¹ Dain, *Tradition*, 16 and n. 3

¹² *Ibid.*, 16 and n. 2. It is worth adding that Leo VI (*Taktika* XIX:57) also mentions the devices, which he describes as “recently fabricated” (παρὰ τῆς ἡμῶν βασιλείας ἄρτι κατασκευασμένα).

¹³ For this usage and date see Atsalos, *Terminologie*, 106ff. I am grateful to Alice–Mary Talbot for bringing this reference to my attention.

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teenth-century Vindobonensis phil. gr. 120, and paralleled by another branch found with more complete text in Paris. suppl. gr. 607 dated to the second quarter of the tenth century.¹⁴ The Byzantine commentator indicates that to understand his sources one would need one of the “engineers” (μηχανικοί) who composed them. He states that his objective is to make it possible for siege machines to be constructed “by anyone” (παρὰ τῶν τυχόντων), phrasing derived from Apollodorus; he subsequently describes his potential users as military leaders seeking to besiege Arab cities (*Parangelmata* 58). He also indicates (*Geodesia* 6) that he has added examples, particularly mathematical examples, for “beginners” (οἱ εἰσαγόμενοι), referring “the more accomplished” (οἱ ἐντελέστεροι) to the works of Archimedes and Heron. He thus writes for a mixed audience, but with the express intent of making his sources’ engineering descriptions accessible to nonengineers. He also provides generic statements of his own methodological approach to achieve this objective, an approach that incorporates a new view of how to present technical material in a format that will lead to practical results. The anonymous author illustrates his general statements with numerous specific examples in both treatises.

Textual Changes

The Anon. Byz. describes the core of his method of textual presentation at two points in the *Parangelmata*: “Having clarified only the works of Apollodorus as it were in toto, with additional elaborations and secondary arguments, we have drawn our conclusions, finding and adding ourselves numerous concordant <items>. Everything we have collected here and there from the remaining <writers> is easy to know and apprehend truthfully, “axioms of common intuition” as Anthemios says, and capable of being comprehended from the problem alone and the illustration; they require no instruction or interpretation” (1:25–33); “all writing on siege warfare requires . . . sometimes also repetitions and reiterations and secondary arguments (ταυτολογιῶν καὶ ἐπαναλήψεων καὶ ἐπενθυμημάτων) for comprehension of the concepts and operations” (3:4–8). He also indicates (1:33–

¹⁴ Dain, *Tradition*, 19–20, following Wescher, xxxviii.

34) that he will use common diction (ιδιωτεία λέξεων) and simple style (ἀπλότητι λόγου), although this is clearly a *topos*.¹⁵

The rhetorical terminology (ἐπεργασίαι, ἐπενθυμήματα, ταυτολογίαι, and ἐπαναλήψεις) employed here may reflect an acquaintance, direct or more likely through handbooks, with the Hermogenic corpus.¹⁶ The precision with which the Anon. Byz. uses the technical terms, however, is uncertain; he is not writing a rhetorical piece but an instructional manual. Yet he is clearly attempting to give his method a consciously articulated framework unlike anything found in his sources. His reworkings and clarifications of these sources are varied in nature and at times helpful, in other cases obvious and pedantic. He sometimes changes aspects of the sequence of presentation in his sources: for example, at *Parangelmata* **13**:13–14 the Anon. Byz. mentions early in his description that excavating tortoises are wheeled, a fact mentioned by his source Apollodorus only at the end. He also inserts lengthy mathematical examples: for example, at *Parangelmata* chap. **38** he compares in detail the dimensions of two mobile siege towers with special emphasis on their proportional relationships and in chap. **51** adds dimensions for a mobile landing tube, again with emphasis on proportion. He frequently inserts similes in the *Parangelmata*, comparing the blade of a borer to a garden spade (**17**:12–13), the base of a scout-ladder to an uncial letter Η (**27**:15), clamping caps to pivot sockets (**22**:35–37), metal washers to clay pipes (**44**:24), and so on. Finally, he adds his own interpretations of technical issues, for example on the nature of a torsion system attached to a battering ram (**44**:18–20) and on a system for maintaining equilibrium between two yoked ships (**53**:33–34).

Two other methods of clarification deserve examination in greater detail. First, the Anon. Byz. frequently adds directional information: for example, at **5**:2–3 Apollodorus’ “rolling objects” (τὰ ἐπικυλιόμενα) become “objects being rolled down from above by the enemy” (τὰ ἄνωθεν ἀπὸ τῶν ἐναντίων ἐπικυλιόμενα); at **7**:2–3 to Apollodorus’ instruction

¹⁵ For the *topos* in the 10th century see R. Browning, “The Language of Byzantine Literature,” in S. Vryonis, ed., *The Past in Medieval and Modern Greek Culture* (Malibu, Calif., 1978), 103–33 (repr. in R. Browning, *History, Language and Literacy in the Byzantine World* [Northampton, 1989], XV), esp. 103–4 with citations of similar sentiments in Leo VI, *Taktika* and *De admin.*

¹⁶ On the rhetorical terminology see the related notes in the commentary.

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for besiegers to dig a defensive ditch the Anon. Byz. adds at the outset, “Beginning from below from the foot of the slope” (ἐκ γὰρ τῆς ὑπωρείας κάτωθεν ἀρχομένους); and at **16:10–11** the addition “from the outer facade” (ἀπὸ δὲ τῆς ἔξωθεν ὄψεως) indicates more precisely where a hole is to be drilled in a metal laminated jar. Second, the author provides logical explanations of statements made by his sources. For example, at **11:14–15**, drawing on Philo Mechanicus’ defensive tactic of burying empty jars over which troops can walk, but which siege machines cause to collapse, halting the machines, he adds the (obvious) explanation that it is the weight of the machines that causes the collapse (λίαν βαρυτάτοις οὔσι) and a specific mention that the jars break under the weight (ἐπὶ τῇ θραύσει καὶ ἐπιδόσει τῶν ὑποκειμένων κεραμίων). At **12:16–18** he adds to Philo’s description of inflatable leather ladders the explanation: “For when they are inflated and full of air <and> kept from deflating, they necessarily become upright, held firm for climbing by the air” (ἐμφυσωμένων γὰρ καὶ πνεύματος πληρουμένων τοῦ διαπνεῖν κωλυομένων, ἐξορθοῦσθαι αὐτὰς ἀνάγκη, ὑπὸ τοῦ πνεύματος ἀντεχομένων πρὸς τὴν ἀνάβασιν). At **13:10–11** to Apollodorus’ recommendation for the use of three, four, or five beams in constructing an excavating tortoise the Anon. Byz. adds, to explain the five-beam approach, “for thicker and more solid results” (διὰ τὸ πυκνότερον καὶ στερεώτερον τοῦ ἔργου). Again, at **39:6–7** he adds “so that the tower may be maintained steadfast in position when turbulent battle is joined” (ὅπως ἐπὶ τῇ συμβολῇ καὶ τῷ κλόνῳ τῆς μάχης ἀκλινήσῃ πρὸς τὴν στάσιν ὁ πύργος συντηρῆται) to explain the purpose of the underplate of the portable siege tower of Apollodorus. It is presumably such directional and explanatory insertions that the author characterizes as “additional elaborations and secondary arguments” (ἐπεργασίαι and ἐπενθυμήματα), which he believes will aid the reader’s comprehension.

The Anon. Byz.’s third named category, tautology, can be seen, for example, at **15:5**, “greasy and viscous” (λιπαρὸν καὶ κολλώδη); **39:2**, “even and level” (ὀμαλὸς καὶ ἰσοπέδιος); **53:5**, “well known and obvious” (εὐγνώστους . . . καὶ φανεράς). In each case he has added the second adjective to the text of his source. Tautology is combined with vocabulary change at **22:2**, “to shatter and break” (ῥηγνύειν καὶ διασπᾶν) for “shake” (σεισαι) in Apollodorus, and at **44:10–11**, “being pulled up and falling” (ἐκσπῶνται . . . ἐκπίπτωσι) for Apollodorus’ “be dislodged” (ἐξάλλωνται).

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The Anon. Byz. also mentions in his methodological discussion (1:21–22) a concern that “the scientific terms are not familiar to the common speech” (καὶ ἀσυνήθη κοινοῖς τυγχάνει λόγοις τὰ τῶν ἐπιστημῶν ὀνόματα). While the phrase is taken directly from his source Apollodorus, the Anon. Byz. clearly shares his concern and makes numerous changes in the interest of clarity. In many cases these appear to involve substitutions of general terms or periphrases for technical or rarer ones, distinctions sometimes difficult to capture in translation: for example, “poles” for “vine-poles” (ξύλα for κάμακες) at **10:4**; “points” for “spikes” (ξίφη for στύρακες) at **10:14**; “openings” for “niches” (διάχωρα for ζωθήκαι) at **14:2**; “bindings” for “ties” (δεσμά for ἄμματα) at **56:12**; “blade . . . narrowed . . . in front” for “apex” (πέταλον . . . ἐπὶ τὸ ἔμπροσθεν . . . ἐστενωμένον for ὁ οὐραχός) at **17:10–12**; “these beams that come down” for “swipes” (ταῦτα . . . κατερχόμενα for τὰ κηλώνια) at **27:30–31**. Others may reflect contemporary usage: for example, σαθρότερα for ἀσθενεστάτους (**4:10**); λαός for ὄχλος (**10:1**); λακκίσματα for τέλματα (**11:7**); ὑποδήμασι for ἐνδρομίδες (**11:20**); ἀυλίσκον for σύριγξ (**16:13**); πέταλον for λεπίς (**17:10**); ἐπανάπτεισθαι for ἐρεθίζεσθαι (**19:24**).

Thus the Anon. Byz. explicitly states his own methodological approach to updating and clarifying the textual aspects of his classical sources and can be shown to apply the method extensively, adding explanations and simplifying vocabulary for nonengineering readers. These changes are noted in more detail in the commentary.

Changes in Illustrations

Even more interesting in terms of methodology is the Anon. Byz.’s description of his new approach to illustration of the devices described and their actual illustration in the archetype.¹⁷ In his introductory sentence to the *Parangelmata* the Anon. Byz. comments that poliorcetic

¹⁷ For an earlier version of this argument see the abstract of my paper “Technical Illustration and Neoplatonic Levels of Reality in Vaticanus Graecus 1605,” *Abstracts of the 19th Annual Byzantine Studies Conference, 4–7 November 1993* (Princeton, N.J.), 96–97, and my “Tenth Century Byzantine Offensive Siege Warfare: Instructional Prescriptions and Historical Practice,” *Byzantium at War (9th–12th c.)* (Athens, 1997), 179–200, esp. 198–99.

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concepts (νοήματα) are hard to grasp, that they are perhaps comprehensible by “‘ignorance’ alone” (τῇ ἀγνωσίᾳ μόνῃ), as they do not obtain clarity “from looking at the drawings” (ἀπ’ αὐτῆς τῆς τῶν σχημάτων θέας). Examples of the drawings in his sources which evoked this response are presumably contained in Vindonbonensis phil. gr. 120 and closely paralleled in Paris. suppl. gr. 607. The drawings in those manuscripts may be characterized as peculiar in their combination of ground plan and elevation in a single composition and in the addition of some depth to the elevations. Also various parts of the devices are sometimes presented and labeled individually to clarify their function, but with resulting loss of an indication of their relationship to the whole. In some illustrations reference letters are employed and cited in the text.¹⁸ In origin technical plans, by the tenth century they have become a strange hybrid.¹⁹ A number of these characteristics are visible in the drawings of the ram-tortoise of Hegetor reproduced in fig. B. The Anon. Byz. indicates (1:37–39) that to facilitate understanding he will not employ the method of drawing that he finds in his sources, but combine his improved verbal descriptions “with the drawings, giving these precise definition” (σὺν τοῖς σχήμασιν ἀκριβῶς διορισάμενοι), thus producing “an illustration . . . well defined” (σχηματισμὸς καλῶς διορισθεῖς).

The reading “ignorance” (ἀγνωσία), emended by previous editors²⁰ working from apographs, is also in the archetype and, I suggest, correct, employed here as used frequently in the sense “unknowing” employed by Pseudo-Dionysius. For example, *De mystica theologia* I:3: “into the darkness of unknowing in which one rejects all the perceptions of knowing” (εἰς τὸν γνόφον τῆς ἀγνωσίας . . . καθ’ ὃν ἀπομυεῖ πάσας τὰς γνωστικὰς ἀντιλήψεις), and II:1: “through unseeing and unknowing to see and know what is beyond seeing and knowing” (δι’ ἀβλεψίας καὶ ἀγνωσίας ἰδεῖν καὶ γινῶναι τὸ ὑπὲρ θέαν καὶ γινῶσιν). This “negative cognition,” a condition accomplished by the rejection of apprehension

¹⁸ See Wescher, xxiv.

¹⁹ The relationship, if any, between the drawings in the Paris manuscript and the original drawings of the classical poliorcetic authors is, of course, a very remote one; see Sackur, *Vitruv*, 19–21; Lendle, *Texte*, xx and n. 8; idem, *Schildkröten*, 122; and Marsden, *Treatises*, 62.

²⁰ ἐννοία (in the margin of London add. 15276, 16th century); εὐγνωσία (Martin); διαγνωσία (Wescher); εὐγνωμοσύνη (for ἀγνωσία μόνῃ) (Schneider).

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through the senses, results from ἀφαίρεσις, variously translated “removal,” “abstraction,” or “denial,” which involves ascent to universals by removal of particulars (ibid., II:1: ἀπὸ τῶν ἐσχάτων ἐπὶ τὰ ἀρχικώτατα τὰς ἐπαναβάσεις ποιούμενοι, τὰ πάντα ἀφαιροῦμεν, ἵνα ἀπερικαλύπτως γνῶμεν ἐκείνην τὴν ἀγνωσίαν).²¹ On this reading the source drawings the Anon. Byz. criticizes are conceptualized by him as at a level of reality beyond normal sense perception and thus beyond the capability of anyone but trained engineers to comprehend. A comparison of the illustrations of the ram-tortoise of Hegetor found in Vindobonensis phil. gr. 120 and Paris. suppl. gr. 607 with the same tortoise as illustrated in the Vaticanus conveys this difference clearly (fig. B). The choice of the term may represent an example of a major principle of Byzantine rhetoric, that “obscurity” is a virtue of style, a principle connected with “the sense of the mystical, the understanding of the relation between the universal and the particular.”²²

The Anon. Byz.’s contrast of “drawing” vs. “illustration” (σχῆμα/ σχηματισμός) (the latter term occurs twice in the introductory paragraph, once in the conclusion to the *Parangelmata*, and again in a scholion in the *Geodesia*) is also paralleled in Neoplatonism. Simplicius’ use of the contrast has been characterized by C. Luna as representing “le rapport de participation entre la figure transcendante et l’objet sensible.”²³ At *In Aristotelis Categorias commentarium* 8:271:26, for example, Simplicius, following Archytas, comments that Aristotle’s fourth category, “quality” (ποιότης), resides not ἐν σχήματι . . . ἀλλ’ ἐν σχηματισμῷ; earlier (8:21:14–19), commenting on the distinction between Socrates and a picture (εἰκόν) of Socrates, he defines the latter as an “illustration of colors” (χρωμάτων οὐσα σχηματισμός), which he later (8:21:18–19) calls

²¹ For discussion of the concept see S. Lees, *The Negative Language of the Dionysian School of Mystical Theology* (Salzburg, 1983), esp. I:140–41: “Ps. Dionysius effectively proposes a new method of apprehension which is appropriate to the incomprehensibility of its object — a method whose alienation from natural processes of sensual and intellectual perception is imaged in, rather than properly described by, the paradoxical construction of the individual words.” For the *via negativa* in mathematics, see J. Whittaker, “Neopythagoreanism and Negative Theology,” *Symbolae Osloenses* 44 (1969), 109–125.

²² See Kustas, *Rhetoric*, 12.

²³ I. Hadot et al., *Simplicius: Commentaire sur les Catégories*, fasc. III (Leiden, 1990), 148.

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a “surface σχῆμα” (σχήματος ἐπιπολαίου); he also says (8:261:24–26) regarding “quality” that “it must be comprehended according to the σχηματισμός of the surface” (ληπτέον . . . κατὰ τὸν τῆς ἐπιφανείας ποιὸν σχηματισμόν). “Quality” here is used in the sense of Aristotle, *Categoriae* 10a11: “the external form of each thing” (ἡ περὶ ἕκαστον ὑπάρχουσα μορφή). These and other passages in Simplicius, then, specifically use the σχῆμα/σχηματισμός contrast to distinguish between the generalized concept and the individual reality the senses perceive. This is particularly clear in the definition in the passage cited above of the σχηματισμός as a “surface σχῆμα” (ἐπιπόλαιον σχῆμα).²⁴

Finally, the term “give definition to” (διορίζεσθαι), used to describe how a σχῆμα will become a σχηματισμός, is paralleled by references in Neoplatonic authors. At *In Aristotelis Categoriae commentarium* 8:217:27–29, for example, Simplicius has τὰ ἀσώματα εἶδη, διὰ τούτων ἐμφαίνεται, ἀλλ’ ἄτακτα καὶ ἀδιόριστα πάντα τὰ τοιαῦτα φέρεται παρ’ αὐτοῖς, and at 8:261:21–23 where the category of ποιότης is described: διότι ἐπιπολῆς καὶ οἶον ἔξωθεν ἐπ’ ἐσχάτῳ τοῦ σώματος συνίσταται. πολυμερὲς δέ ἐστιν καὶ πολυειδὲς τὸ γένος τοῦτο. καὶ ἔστιν ἐν αὐτῷ σχῆμα μὲν τὸ ὑπὸ τινὸς ἢ τινῶν ὄρων περιεχόμενον.²⁵ Thus “to give definition or definiteness” (ὄρος) to a σχῆμα is used in some Neoplatonists of giving it the externalities or particulars of quality.²⁶ Here then the Anon. Byz. seems to complete,

²⁴ Similar uses of σχηματισμός alone as a representation of superficial appearance can also be found in Pseudo-Dionysius (e.g., *Epistula* 9:2: προσέτι δὲ καὶ τῶν νοητῶν ἅμα καὶ νοερῶν ἀγγέλων οἱ θεοειδεῖς διάκοσμοι ποικίλαις μορφαῖς διαγράφονται καὶ πολυειδέσι, καὶ ἐμπυρίοις σχηματισμοῖς) and in Macarii Aegyptii *Epistolae* (PG 34:413C): ἕκαστος ἡμῶν νοητὴ συκῆ, παρ’ ἧς ὁ κύριος τὸν ἔνδον καρπὸν ἐπιζητεῖ, καὶ οὐ τὸν ἐκ φύλλων ἐπικείμενον σχηματισμόν, among others. The distinction can also be seen at different levels of reality in Plotinus, *Ennead* VI:7:14: ἐν ἐνὶ σχήματι νοῦ οἶον περιγραφῆ ἔχων περιγραφῆς ἐντὸς καὶ σχηματισμοῦς ἀπὸ ἐντὸς . . .

²⁵ See also Simplicius, *In Aristotelis Physica commentaria* 9:537:15–16: τὸ δέ ἐστι πέρας καὶ ὄρος τοῦ ἀόριστου διαστήματος ὀριστικόν τε καὶ περιεκτικόν, καὶ τοῦτο μὲν ἐστὶ τὸ εἶδος (“there is boundary and a defining limit which makes the indefinite extension definite and embraces it, and this is form”); trans. R. Sorabji, “Simplicius: Prime Matter as Extension,” in I. Hadot, *Simplicius: Sa vie, son oeuvre, sa survie* (Berlin, 1987), 148–65, specifically 163. Cf. Simplicius, *In Aristotelis Categoriae commentarium* 8:28:4–6: τὸ δὲ κοινὸν καὶ ἀόριστον . . . ὅπερ μετὰ τοῦ διορισμοῦ ληφθὲν τὸ κοινὸν ἰδιωθὲν καὶ ἀπομερισθὲν παρίστησιν.

²⁶ For discussion see Sorabji (as in previous note) and cf. Aristotle, *Analytica Posteriora* 81b7–8: τῶν γὰρ καθ’ ἕκαστον ἡ ἀίσθησις (“sense perception apprehends particulars”).

by choice of terminology, his conceptualization of his new approach to technical illustration as at the level of what the senses see, the surface appearance, while suggesting that the approach found in his sources is at a higher level of abstraction.

The validity of this interpretation is strengthened not only by the nature of the illustrations in Vat. gr. 1605, but also by overt references in the texts. The Anon. Byz. (3:9–14) cites Porphyry (ὁ πολὺς ἐν σοφίᾳ), on Plotinus (ὁ μέγας), that Plotinus was “concerned only with the concept and the things. For he knew that reality is tripartite: words, concepts, and things” (μόνου τοῦ νοῦ καὶ τῶν πραγμάτων ἐχόμενος. Τριττὰ γὰρ τὰ ὄντα ἡπίστατο, ἔν τε φωναῖς νοήμασί τε καὶ πράγμασι). The phrase “and the things” (καὶ τῶν πραγμάτων) is not in any manuscript of the cited passage of Porphyry’s *Vita Plotini* and has apparently been added here by the Anon. Byz. to the citation. The view of reality as tripartite is found in the sixth-century Neoplatonists Olympiodorus and Elias.²⁷ The sentence also seemingly reflects what S. Gersch²⁸ has described in another context as the extensive Neoplatonic controversy about the subject of Aristotle’s *Categories*,²⁹ whether it classifies “words” (φωναί), “things” (πράγματα), or “concepts” (νοήματα), and which as Gersch notes was commented on by Porphyry and is, among extant works, best documented in Simplicius. The Anon. Byz. next argues (3:18–22) that one who errs about “things,” his worst-case scenario, falls into Plato’s “double ignorance,” ἄγνοια (“knowing that one knows and not understanding that one is ignorant”). Thus the Anon. Byz. cites Plato and Neoplatonists by name, deliberately supplements the text of the *Vita Plotini* to mark a contrast between “concepts” and “things” (νοήματα and πράγματα), shows a specific, if unsophisticated,³⁰ knowledge of Neoplatonic epistemology,

²⁷ See Olymp. Phil., *Proll.* 18:25–27, and Elias Phil., *In Cat.* 129:9–11.

²⁸ *From Iamblichus to Eriugena* (Leiden, 1978), 96 n. 76.

²⁹ On the centrality of Aristotle’s *Categories* and Porphyry’s commentary thereon in Byzantine philosophical education, as well as the growing interest in Neoplatonism in the late 9th and 10th centuries before the “renaissance” associated with M. Psellos, see R. Browning, *The Byzantine Empire*, rev. ed. (Washington, D.C., 1992), 138, and Lemerle, *Byzantine Humanism*, 251–55.

³⁰ The Anon. Byz. appears to use two levels of reality, that of sense perception and a level above, which he uses of both νοήματα and mathematical objects ἐν φαντασίᾳ, levels that are often distinguished by some Neoplatonists (see, e.g., the distinction between φαντασία and διάνοια in Syrianus below, note 31). Gersch, however, observes

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and evinces a clear preference for the sensible realities (πράγματα).

In the *Geodesia* (6:29, 37) the Anon. Byz. describes geometrical figures as existing “in concept and reality . . . in reality and imagination” (νοήσει τε καὶ αἰσθήσει . . . αἰσθήσει τε καὶ φαντασίᾳ), reflecting again dual levels of reality, here most similar to those found especially in Proclus.³¹ A number of the geometrical figures in Vat. gr. 1605 are notable in their realistic qualities, for example, a circle depicted with rocks and bushes on its perimeter (chap. 7), a human figure with a rope measuring a circle (chap. 7), and a cistern depicted with individual bricks visible and filled with water to illustrate calculation of the volume of a rectangular solid (chap. 9).³² Finally, the Anon. Byz.’s stated purpose for his modified verbal descriptions in the introductory passage of the *Geodesia* (1:28–30) exemplifies as well his approach to illustration: “to bring down to a low and more sensible level the height of their theory concerning these concepts” (καὶ τὸ ὑψηλὸν τῆς περὶ τὰ νοήματα θεωρίας ἐπὶ τὸ ταπεινὸν καὶ αἰσθητικώτερον κατενεγκεῖν).³³

(94 n. 61, as above in note 29) that for convenience of argument the Neoplatonists “sometimes speak simply of two levels: sensible (immanent) Forms and psychic Forms (concepts).”

³¹ See esp. Proclus, *In primum Euclidis librum commentarius* 51:14–21 and G. Morrow, *Proclus, A Commentary on the First Book of Euclid’s Elements* (Princeton, N. J., 1970) 41 n. 5 on the idea of φαντασία as a form of νόησις. See also the interesting passage in Syrianus (*In Metaphysica commentaria* 6:98:26ff (on 1078a14) on the place of φαντασία in practical construction: ὁμοίως καὶ ὁ μηχανικὸς τὴν ὕλην σχηματίζων ἐπ’ ἀνάγει πᾶσαν ἑαυτοῦ τὴν ποίησιν ἐπὶ τὰ ἄυλα σχήματα καὶ ἐν φαντασίᾳ μὲν διαστατῶς, ἐν διανοίᾳ δὲ ἀμερῶς τὴν ὑπόστασιν ἔχοντα. G. Watson, *Phantasia in Classical Thought* (Galway, 1988), 119 comments on this passage: “When someone is making something, for instance, he shapes his matter in accordance with an immaterial blueprint (schemata), which exists unextended in the mind and in extended fashion in phantasia.” The Anon. Byz., I suggest, is arguing for the educational value of descending still one level of reality further down.

³² One other passage provides evidence of the author’s interest in the effect of realistic representation. In a recommendation in the *Parangelmata* (52:5–10) not found in his classical sources he suggests for the doors of a *sambuca* (a tubelike troop carrier): Αἱ δὲ τοῦ αὐτοῦ στομίου θύραι ἔξωθεν καταπληκτικαὶ διὰ γλυφῆς ἐκφανοῦς καὶ πολυχρώμου γραφῆς σὺν τῷ ἐμπροσθίῳ μέρει τοῦ αὐλοῦ γινέσθωσαν, δράκοντος ἢ λέοντος πυροφόρον ἐπιφερόμεναι προτομήν εἰς κατάπληξιν καὶ φόβον τῶν ἐναντίων προσερχομένων.

³³ It is worth noting that even the traditional geometrical drawings found in the *Geodesia* (used to show measurement of the height of a wall, distances between points in the horizontal plain, and so on) are given a concrete quality by examples in the text

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I suggest, then, that the approach to poliorcetic, and to a lesser extent geometric, illustration in Vat. gr. 1605 is consciously articulated in his text by the Anon. Byz.³⁴ Reversing the Neoplatonic³⁵ idea of ascent from what the senses perceive to the νοήματα, he replaces “schematic” drawings, conceived of as objects “in thought” and “in imagination,” with “sensibles” to achieve a practical educational purpose, and specifically describes the process, “give definition to, particularize” (ἀκριβῶς διορίζεσθαι) the σχήματα. Such use of depictions of finished devices was perhaps initially more acceptable in an “original” Byzantine compilation, one not bound by the dictates of the classical tradition. Therefore, the so-called Heron of Byzantium would appear to be the first adapter of realistic representation to the poliorcetic genre, with a new pedagogical vision, both textual and especially pictorial, of how his contemporaries could best learn to create physical objects. He brings to the genre a method that is quite new, even though one flawed by misinterpretations and errors.

The Errors

Otto Lendle comments that the Anon. Byz. interpreted the work of Apollodorus “nach seinem (manchmal überzeugenden, gelegentlich in

set in the Hippodrome of Constantinople, e.g. (*Geodesia* 2:15–16), ὡς [τοῦ] ἀπὸ τοῦ (ἐπὶ) ἐδάφους τῶν θυρῶν ὑποτεθέντος B πρὸς τὸ ἐπὶ μέρους τινὸς τοῦ τεθρίππου σημειωθέν A (“from <point> B assumed at the bottom of the doors to point A noted on some part of the quadriga”).

³⁴ The illustrations in Vat. gr. 1605 are, of course, at least once removed from those that accompanied the Anon. Byz.’s original work. Given the specific verbal description he provides of his approach to illustration and the conservatism of illustrators, it seems reasonable to assume that many of the main characteristics of the illustrations in the Vaticanus follow those in the autograph. Whether the illustrator of the Vaticanus introduced additional innovations is uncertain.

³⁵ Other indications of Neoplatonic influence in the Anon. Byz. include his characterization in the *Geodesia* (7:47–48) of the radius of a circle as ἐν ἀρχῇ . . . ἀπ’ ἀρχῆς . . . ἐπ’ ἀρχήν, an image widely found in Neoplatonic authors, especially Plotinus (e.g. *Ennead* V.1:10), Pseudo-Dionysius (e.g., *De divinis nominibus* 5) and Proclus (e.g., *In primum Euclidis librum commentarius* 155:6–8: Ἄλλ’ ὡς μὲν τῆς διαστάσεως ἀρχὴ τῶν γραμμῶν τῷ “ἀφ’ οὗ” σημαίνεται, ὡς δὲ μέσον τῆς περιφερείας τῷ “πρὸς οὗ”), and his reference to Pythagorean views of the cube as representing “harmony” (*Geodesia* 8:13–15).

die Irre gehenden) Verständnis.”³⁶ In addition to occasional and serious misinterpretations of the sources, the Byzantine author also makes some errors in mathematics and in his “astronomical” methodology. In the first category, for example, W. Sackur observed that the Anon. Byz. misinterprets the method of diminishing the size of each upward story of the portable siege tower of Diades as one based on area rather than on width (*Parangelmata* 30), with resulting errors in his description of Apollodorus’ tower.³⁷ In the second category the Byzantine author (*Geodesia* 8) incorrectly computes the surface area of a cone, apparently due to his misinterpretation of Archimedes. Finally, T. H. Martin (394–95) has noted, among a number of problems, that the Byzantine “paraît avoir confondu, de même que les anciens astrologues, les *ascensions droites* avec les *ascensions obliques*, et avoir confondu aussi *déclinaisons* avec les *latitudes*.” Such errors are noted in the commentary. Sackur’s general characterization (*Vitruv*, 106) seems not unfair: “Der Anonymus Byzantinus ist ein sehr gewissenhafter Arbeiter . . . aber ein eigentlich technisches Denken . . . dürfen wir bei ihm nicht erwarten.”

The Tenth-Century Context

The tenth century witnessed a flowering of interest in codifying and transmitting methods of warfare. This interest occurred in large part as a response to the Arab threat and the accompanying shift from a defensive to an offensive posture on the part of the Byzantine state.³⁸ One primary focus of the shift was Crete, lost in about 826 and the objective of numerous expeditions, including the failed expedition in 949 (the preparations for which are described in detail in *De cerimoniis*, 669ff) and the final success of Nikephoros Phokas in 960–961. Other foci of the tenth-century offensive included Muslim territory in Cilicia and northern Syria. The taking of walled cities and fortifications was a significant part of such expeditions (e.g., Melitene, Edessa, Chandax, and Aleppo). The list of military manuals compiled during the period includes Leo VI’s *Taktika* (ca. 905), *De obsidione toleranda* (after 924), the

³⁶ Lendle, *Texte*, xx.

³⁷ Sackur, *Vitruv*, 106.

³⁸ See E. McGeer, “Infantry vs. Cavalry: The Byzantine Response,” *REB* 46 (1988), 135.

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Sylloge tacticorum (ca. 950), the *Præcepta militaria* attributed to Nikephoros Phokas (ca. 965), the *De re militari* (ca. 975), *De velitatione* (ca. 975), and the *Taktika* of Nikephoros Ouranos (ca. 1000).³⁹ Most of these take a comprehensive view of warfare; some, however, present siege warfare as one facet of the whole enterprise. Thus chap. 15 of Leo's *Taktika* is entitled Περὶ πολιορκίας πόλεων, chap. 21 of the *De velitatione* Περὶ πολιορκίας κάστρου, chap. 21 of the *De re militari* Περὶ πολιορκίας, and chap. 65 of Ouranos' *Taktika* Περὶ καστροπολέμου.

The degree of realism in these texts has been the subject of recent scholarly interest.⁴⁰ Among the issues considered have been the extent to which they simply preserve classical sources and with what intent, how useful the classical techniques were in the tenth-century context, and how much specifically contemporary material they contain. Gilbert Dagron has suggested three criteria for judging relative modernity: (1) the attention paid to the evolution of military technology, although this, as Dagron notes, admittedly saw no radical transformation; (2) the description of the enemy, for example, ethnic nature, social composition, and military methods; and (3) the composition and structure of the Byzantine army, including recruitment, administrative and political status, and the appearance of a military caste.⁴¹ Of Dagron's latter two criteria there is little evidence in the Anon. Byz. With regard to the enemy the Anon. Byz., in explaining the purpose of his work, says that if they (i.e., the Byzantines) construct siege machines by the methods he describes, military leaders "will easily capture cities, especially those of Agar and themselves suffer nothing fatal from the God-damned enemy" (εὐχερῶς τὰς τῆς Ἄγαρ μάλιστα λήψονται πόλεις, αὐτοὶ μὴθὲν ἀνήκεστον ὑπὸ τῶν θεολέστων ἐχθρῶν πάσχοντες, chap. 58). It is thus specifically against Arab cities that he sees his work as being employed. The use of the adjective θεόλεστος may also be indicative. The word occurs three times in *De cerimoniis* (514:5 and 9, 651:15) in the phrase "against God-damned Crete" (κατὰ τῆς θεολέστου Κρήτης) with regard

³⁹ For a review of the military manuals see Dain, "Stratégistes," passim. Individual articles on most of these are contained in the *ODB*.

⁴⁰ See T. G. Kolias, "The *Taktika* of Leo VI the Wise and the Arabs," *Graeco-Arabica* 3 (1984), 129–35; G. Dagron, *Traité*, 139–60; E. McGeer, "Infantry," 136; and McGeer "Tradition," 129–40.

⁴¹ Dagron, *Traité*, 142.

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to the expedition of 911 under Himerios, and in the Δημηγορία Κωνσταντίνου βασιλέως πρὸς τοὺς τῆς ἀνατολῆς στρατηγούς 5:13: κατὰ τῶν χωρῶν καὶ κάστρων τῆς θεολέστου Ταρσοῦ.⁴² Theophanes (ὑπὸ τοῦ θεολέστου αὐτῶν ἔθνους) also uses the term in connection with Arabs.⁴³ The adjective, as well as the specific reference to Arab cities, thus sets the intent of the treatise in line with Byzantine objectives of the 940s and 950s.

Concerning the third criterion, the Anon. Byz. says nothing on issues of military recruitment, or the political and administrative nature of the army and makes only brief, but interesting, mention of the army's officer class. At the end of the *Parangelmata*, in the sentence whose conclusion was quoted above, he begins: "If army commanders carefully complete with logic and continuous diligence these siege machines, which have been selectively compiled for description and illustration, and always contemplate divine justice, being honored for their fairness and reverence, and strengthened and guarded by the powerful hand and cooperation and alliance of the God-crowned and Christ-loving emperors of Rome" ((Τ)αῦτα τοίνυν τὰ πρὸς ἀναγραφὴν καὶ σχηματισμὸν κατ' ἐκλογὴν συνταχθέντα πολιορκητήρια μηχανήματα οἱ τῶν στρατευμάτων ἐξάρχοντες μετὰ λόγου καὶ συνεχοῦς μελέτης ἐπιμελῶς κατεργαζόμενοι, τὴν θεῖαν διὰ παντὸς ἐνοπτριζόμενοι δίκην, ἐπὶ δικαιοσύνη καὶ εὐσεβείᾳ κεκοσμημένοι καὶ τῇ κραταιᾷ χειρὶ συνεργεῖα τε καὶ συμμαχίᾳ τῶν θεοστέπων καὶ φιλοχρίστων ἀνάκτων Ῥώμης ἐνδυναμούμενοί τε καὶ φρουρούμενοι). It is thus the military leaders whom he sees as employing his treatise and they are characterized as closely associated with the emperors. Earlier in the treatise, immediately following the introductory material, he says (chap. 4): "The most competent military commander, kept safe by Providence above because of his piety, and obedient to the command and judgment and good counsel of our most divine emperors" ((Τ)ὸν ὑπὸ τῆς ἄνω προνοίας ἐπ' εὐσεβείᾳ συντηρούμενον στρατηγικώτατον ἄρχοντα, τῇ κελεύσει καὶ γνώμῃ καὶ εὐβουλίᾳ τῶν θειοτάτων αὐτοκρατόρων ὑπέικοντα), again linking military leaders with the emperors and here, perhaps rhetorically, but nev-

⁴² Ed. R. Vári, "Zum historischen Exzerptenwerke des Konstantinos Porphyrogenetos," *Byzantinische Zeitschrift* 17 (1908), 75–85.

⁴³ *Chronographia* 499:21 (ed. C. de Boor; repr. Hildesheim, 1963).

ertheless explicitly, describing them as highly skilled. General officers are thus portrayed as close to the emperors and learned in their profession.

On Dagron's first criterion the treatise presents issues of greater complexity. The Anon. Byz. specifically indicates that he is working from classical sources, and thus his work is obviously heavily derivative; he also tells us that he will add material. The author's description of the classical material should, however, be set in the context of his modernization of the method of presentation discussed above, by which both textually and pictorially he seeks to make the classical material more accessible. Further, as Dagron notes, evolution of military technology was not radical, a point that can be substantiated by specific references in tenth-century texts. The historians provide one source of information about siege techniques. John Kaminiates, for example, describes the Arabs besieging Thessalonica in 904 as using siege towers on paired ships, a technique described by the Anon. Byz. in *Parangelmata* 53, following Athenaeus Mechanicus. Whether Kaminiates' description is actually tenth-century, however, has been questioned.⁴⁴ Leo the Deacon (*Historiae* II:7) describes Nikephoros Phokas' siege of Chandax (961) as involving a battering ram and methods of undermining walls also described by the Anon. Byz. (*Parangelmata* chaps. 22–23 and 13–14); but Leo's account has been shown to be heavily dependent on a siege description in Agathias (*Historiae* 1:10).⁴⁵ Anna Comnena (e.g., *Alexiad* XI:1:6–7; XIII:2:3, 3:9) describes portable siege towers, tortoises for filling and excavating, undermining walls, ram-tortoises, and even the importance of the dioptra in correctly constructing siege engines, all items discussed by the Anon. Byz. Yet even here literary influence cannot be completely ruled out.

More helpful are inventory lists and comments of practitioners. In the list of items prepared for the expedition against Crete in 949 the *De cerimoniis* lists a "wooden tower," ξυλόπυργος (670:10–11), "tortoises,"

⁴⁴ A. P. Kazhdan, "Some Questions Addressed to the Scholars Who Believe in the Authenticity of Kaminiates' Capture of Thessalonica," *Byzantinische Zeitschrift* 71 (1978), 301–14. For an opposing view, however, see J. Frendo, "The Miracles of St. Demetrius and the Capture of Thessaloniki," *Byzantinoslavica* 58 (1997), 205–24.

⁴⁵ C. B. Hase, *Leonis Diaconi Historiae libri X* (Bonn, 1828), 419, note 25: 19.

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χελώναι (670:11), and “ram-tortoises” εἰς . . . τὰς χελώνας κριοί (670:13, 671:4–5, 673:1), all classical devices covered in considerable detail by the Anon. Byz. Nikephoros Ouranos (*Taktika* 65:22) comments: “The men of old, in their pursuit of siege warfare, constructed many devices such as battering rams, wooden towers, scaling ladders with various features, tortoises, and all kinds of other things which our generation can hardly imagine. It has, however, tried all these devices and found that out of all of them, the most effective way, one which the enemy cannot match, is undermining the foundations, all the more so if one does so with careful scrutiny and method, and has the accompanying and extremely helpful protection of *laisai* (mantlets)” (Οἱ μὲν γὰρ παλαιοὶ ἔχοντες τὴν σπουδὴν εἰς καστροπόλεμον ἐποίουν καὶ μηχανήματα πολλὰ οἷον κριοὺς καὶ πύργους ξυλίνοὺς καὶ σκάλας ἐχούσας ἄλλα καὶ ἄλλα ἰδιώματα, καὶ χελώνας καὶ ἄλλα περισσότερα ἄπερ ἡ ἡμετέρα γενεὰ οὐδὲ ἰδεῖν ἴσχυσε· πλὴν ἀπεπείρασε τὰ ἅπαντα καὶ εὗρεν ἐκ πάντων τούτων ἐπιτηδειότερον καὶ ἀναπάντητον τοῖς ἐχθροῖς τὸ διὰ τῶν θεμελίων ὄρυγμα, ἂν ἄρα καὶ μετὰ διακρίσεως καὶ τάξεως ποιήσῃ τις αὐτό, ἔχων συνακολουθοῦσαν καὶ βοηθοῦσαν πολὺ καὶ τὴν σκέπην τῶν λαισῶν).⁴⁶ Ouranos thus indicates that his generation has tested various classical siege devices (rams, <mobile> wooden towers, ladders, and tortoises) and found that undermining walls using *laisai* (light weight shelters plaited from branches, a contemporary Byzantine technology) is the most effective technique. The Anon. Byz. includes all of the classical devices mentioned by Ouranos, including methods of undermining walls as well as the contemporary *laisai*. Ouranos’ detailed description (65:18–21) of the undermining of walls using an “excavate, prop, and burn” method has a number of similarities with the description of the Anon. Byz. (*Parangelmata* 13–14). Finally, in the eleventh century, Kekaumenos comments: “Since those wondrous men who have written treatises on war machines constructed rams and engines and many other tools by which they captured cities, I say also to you to construct one of these engines, but if you can to also invent something new. For this is more worthy of praise.” (Ἐπεὶ δὲ οἱ θαυμαστοὶ ἄνδρες ἐκεῖνοι οἱ περὶ μηχανημάτων στρατηγικῶν συγγραψάμενοι ἐμηχανήσαντο κριοὺς καὶ μηχανικὰ καὶ ἄλλα πολλὰ ὄργανα ἐν οἷς εἶλον πόλεις, λέγω σοι κάγω

⁴⁶ Trans. McGeer, “Tradition,” 161–63.

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μηχανήσασθαι μηχανήν τινα ἐξ αὐτῶν, εἰ δὲ δύνασαι, καὶ καινόν τι ἐπινοήσασθαι. Τοῦτο γὰρ μᾶλλον ἐπαίνου ἐστὶν ἄξιον).⁴⁷ Thus classical devices were still considered of value, but even more praiseworthy was innovation, based in part on a knowledge of classical sources.

The Anon. Byz. also indicates (*Parangelmata* 1:27–28) that he will add related information to his paraphrase of Apollodorus, πλείστα καὶ αὐτοὶ σύμφωνα προσευρόντες καὶ παραθέμενοι. Much of this material is drawn from other classical sources, but some is clearly contemporary. Dain has listed among them the wheeled ladder with drop-bridge (chap. 46), excavating tortoise with drop-bridge (chap. 47), various remarks on ladders and bridges, including the handheld στρεπτόν for shooting Greek fire (chap. 49), and improvements to Athenaeus Mechanicus' landing tube (chap. 52).⁴⁸ Eric McGeer has noted references to the clearly contemporary *laisai* (chaps. 9, 17, 47).⁴⁹ A number of other briefer references not found in the classical sources are scattered through the text, for example, the use of urine for cracking heated stones (chap. 16), τοξοβολίστραι (chap. 15), alternate bases for a scout-ladder (chaps. 27, 28), and silk (νήματα σηρικὰ) for torsion springs (chap. 44). The illustrations in Vat. gr. 1605 also provide evidence of contemporary practice. The *laisai* are depicted on folios 8r and 35r, the στρεπτόν on folio 36r, and the human figures are shown in contemporary military dress, felt hats, tunics, and boots (καμελαύκια, καβάδια, and ὑποδήματα).

Thus while the *Parangelmata* and the *Geodesia* are clearly heavily derived from classical sources, the potential practical value that the Anon. Byz. ascribes to them (to “capture cities, especially those of Agar”) is verified by other tenth-century theory and practice for at least some of the devices and methods described. Classical devices were still tried and used in the tenth century: the *De cerimoniais* indicates the use of siege towers, tortoises, and rams; Ouranos indicates trial of numerous such devices, together with innovation, as does the advice of Kekaumenos.

⁴⁷ Ed. G. G. Litavrin, *Sovety i rasskazy Kekavmena* (Moscow, 1972), 148:23–28.

⁴⁸ Dain, *Tradition*, 16 n. 2. Dain's comment, “A dire vrai, dans le texte relatif au πυροβόλον, Héron ne dit rien qui ne se trouve dans Apollodore: ce qui est nouveau c'est la vignette,” is questionable. The Anon. Byz. says μετὰ στρεπτῶν ἐγχειριδίων πυροβόλων (*Parangelmata* 49:20), a description not in his source and clearly referring to a middle Byzantine device.

⁴⁹ McGeer, “Tradition,” 136.

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The Anon. Byz.'s new method of presentation is intended to improve his readers' understanding of classical engineering descriptions, while his inclusion of tenth-century material indicates his awareness of innovation. The contemporary value of such a book is also attested by the remark of Constantine VII, in describing for his son the items to be included in the imperial baggage: "books on mechanics, including siege machinery and the production of missiles and other information relevant to the enterprise, that is to say wars and sieges" (βιβλία μηχανικά, ἐλεπόλεις ἔχοντα, καὶ βελοποιικὰ καὶ ἕτερα ἀρμόδια τῇ ὑποθέσει ἡγουν πρὸς πολέμους καὶ καστρομαχίας).⁵⁰ At the same time, however, it is clear that some items in the text would seem to have only antiquarian interest (e.g., the ram of Hegetor, the largest from antiquity) and others, although derived from the classical sources, are of questionable value (e.g., the inflatable leather ladder from Philo Mechanicus and the raft of Apollodorus). The utility of the works is also compromised by the Anon. Byz.'s errors.

Editorial Principles

K. K. Müller's and Alphonse Dain's studies of the manuscript tradition of the two texts associated with "Heron of Byzantium" convincingly established the archetype value of Vat. gr. 1605; it led Dain to recommend a new edition based on it. Dain also noted the sound state of the text in the Vaticanus and proposed that there were few intermediaries between the original and this copy. His description of Vat. gr. 1605, coupled with those of Müller and Cyrus Gianelli, leaves little to be added.⁵¹ The manuscript is parchment, 258 mm x 210 mm, with 58

⁵⁰ Trans. J. Haldon, *Constantine Porphyrogenitus, Three Treatises on Imperial Military Expeditions* (Vienna, 1990), 106, lines 196–98.

⁵¹ C. Gianelli, *Codices Vaticani Graeci: Codices, 1485–1683* (Vatican City, 1950), 260–62. Gianelli noted that the final folio contains the designation "AND," taken to be the bookmark of Charles of Anjou, suggesting that Vat. gr. 1605 may have been among the books given to the pope after the battle of Beneventum; see also P. Canart, "Le livre grec en Italie méridionale sous les règnes Normand et Souabe: aspects matériels et sociaux," *Scrittura e civiltà* 2 (1978), 103–62, esp. 149 n. 113, and N. Wilson, *Scholars of Byzantium* (Baltimore, Md., 1983), 214. However, A. G. Bagliani, "La provenienza 'angioina' dei codici greci della biblioteca de Bonifacio VIII," *Italia medioevale e umanistica* 26 (1983), 27–69, esp. 43–44, has argued persuasively that the abbreviation is not to be connected with Charles of Anjou and "sembra essere destinata a rimanere misteriosa e sibillina." I am grateful to an anonymous reader for this last reference.

extant folios, and notably contains only the two treatises of “Heron of Byzantium.” Dain’s suggestion of a mid-eleventh-century date (Müller and Gianelli say only 11th century without further specification) might be questioned in light of the recent tendency to place manuscripts earlier.⁵² Of the origin of the manuscript and the reasons for the lack of rubrication we know nothing. Later interlinear annotations⁵³ on folios 4r–v, 6v, 7r, 53v, and 54r and their subsequent erasure have obscured some accents and the upper portion of some letters. The first folio is reproduced in fig. A.

The edition, then, is based on the archetype, Vat. gr. 1605, previously not used in any edition.⁵⁴ Where I have recorded the conjectures of the previous editors, I have, for the sake of clarity, generally also included the related reading of the apograph as they report it; in some instances a negative entry appeared sufficient. In those instances where I have preferred the reading of an apograph to the Vaticanus, the reading of the apograph is also derived from the printed edition. I have not noted in the apparatus editorial conjectures or errors and omissions in the apographs for which the archetype provides correct readings. I have supplied in angle brackets and generally without further notice initial paragraph letters omitted in the Vaticanus⁵⁵ due to lack of rubrication. As the text has generally been cited from Wescher’s and Vincent’s editions, their page numbers are noted in the margin preceded by “Wes” and “Vin”; I have not attempted to retain their line breaks. I have allowed the scribe’s inconsistency in employing elision and *nu* movable

⁵² For such earlier dating generally, see, e.g., Dagron, *Traité*, 14–15.

⁵³ On their likely nature see Gianelli (as above, note 51), 262.

⁵⁴ I note the following errors in Müller’s recorded readings of V, using his listing by Wescher’s and Vincent’s page and line numbers: 217, 2 *επαλιφθέντα*: *επαλιφέντα* V || 252, 9 *υπεμβαίνονται*: *υπεμβαίνοντα* V || 264, 15 *σχάριον*: *σχαρίον* V || 264, 17 *διάμετρα*: *διάμετροι* V || 348, 17 *όλίγον δια γραμμάτων*: *όλίγων* (–ων per compendium) *διαγραμμάτων* V || 350, 5 *πρός τε γεωδεσίαν και*: *πρός τε γεωδεσίαν τε και* V || 350, 6 *τε om.*: *τε* V || 350, 8 *εὐ κρινῆσαι*: *εὐκρινῆσαι* V || 350, 10 *εὐλήπτως*: *εὐλήπτων* (–ων per compendium) V || 376, 14 *ἄπερ*: *ἄσπερ* V || 378, 6 *οἱ δ’*: *ὁ ιδ’* V || 390, 6 *βολιβοῦν*: *μολιβοῦν* V ||. In one instance Müller has not recorded a significant difference, i.e., Vincent 396, 8 has *λβ’* (i.e., “32”); Müller makes no comment, while V has *λβ’ β’* (i.e., “32 2/3”), on which see the related note in the commentary.

⁵⁵ *Parangelmata* 1, 4, 11, 13–20, 22, 24, 25, 27–29, 39^{1, 17}, 42, 43, 45–50, 52, 53, 55–58 and *Geodesia* 1, 3–7, 8^{1, 60, 85, 96, 105}, 9^{1, 46}, 10^{1, 19}, 11.

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to remain as it appears in the manuscript. Errors resulting from iota-cism, homophonic confusions, dittography (e.g., πέταλλον for πέταλον in all but one instance), and incorrect accents and breathings are not recorded unless a different meaning is possible.

Measurement Units in the Text

For specific numerical measurements of length the author uses the δάκτυλος (“finger”), πούς (“foot”), πῆχυς (“cubit”), and ὀργυά (“fathom”); the στάδιον (“stade”) is employed in a scholion. He also mentions the παλαιστή (“palm”) and the σπιθαμή (“span”). Proportional relationships between units of measure are explicitly stated in *Parangelmata* **18** and **38** and in the scholion at *Geodesia* **6**. The author uses $16 \text{ δάκτυλοι} = 1 \text{ πούς}$, $11\frac{1}{2} \text{ πόδες} = 1 \text{ πῆχυς}$, $4 \text{ πήχεις} = 1 \text{ ὀργυά}$; also the $\text{παλαιστή} = 4 \text{ δάκτυλοι}$, the $\text{σπιθαμή} = 12 \text{ δάκτυλοι}$. The author compares (*Parangelmata* **38**) for commensurability different siege towers built using πήχεις and πόδες respectively as the units of measure. In *Geodesia* **9** in measuring the volume of the cistern of Aspar, he makes a comparison between the cubic πῆχυς and ὀργυά a major part of his presentation. An analogous situation exists for units of liquid volume, the κεράμιον and the κάδος. Given the integral nature of the specific measurement units to the text and the differences between, for example, the Byzantine *pous* and the English “foot,” it has seemed best to simply transliterate the measurement terms. The units of length have the following values; for in-depth treatment see Schilbach, *Metrologie*.

1 δάκτυλος, pl. δάκτυλοι (<i>daktylos, daktyloi</i>)	1.95 cm
1 παλαιστή, pl. παλαισταί (<i>palaiste, palaistai</i>)	7.8 cm
1 σπιθαμή, pl. σπιθαμαί (<i>spithame, spithamai</i>)	23.4 cm
1 πούς, pl. πόδες (<i>pous, podes</i>)	31.23 cm
1 πῆχυς, pl. πήχεις (<i>pechys, pecheis</i>)	46.8 cm
1 ὀργυά, pl. ὀργυαί (<i>orgya, orgyai</i>)	1.87 m

Sigla: Variar lectiones et coniecturae

V	Vaticanus graecus 1605, XI
B	Bononiensis Universitatis 1497, XVI
P	Parisinus supplementus graecus 817, XIX
< >	addenda
< . . . >	lacuna
[]	delenda
Dain	Dain, <i>Tradition</i>
Mango	Mango, "Palace"
Mar	T. H. Martin
Marsden	Marsden, <i>Treatises</i>
Sch	R. Schneider
Vin	A. J. H. Vincent
Wes	C. Wescher

Texts and Translations

Parangelmata Poliorcetica

Geodesia

⟨ ΠΑΡΑΓΓΕΛΜΑΤΑ ΠΟΛΙΟΡΚΗΤΙΚΑ ⟩

1. (Ἔ)σα μὲν τῶν πολιορκητικῶν μηχανημάτων δυσχερῆ καὶ
δυσέφικτα πέφυκεν, εἴτε διὰ τὸ ποικίλον καὶ δυσδιάγνωστον
τῆς τούτων καταγραφῆς, εἴτε διὰ τὸ τῶν νοημάτων δύσληπτον
ἢ μᾶλλον εἰπεῖν ἀκατάληπτον τοῖς πολλοῖς, ἴσως δὲ τῇ ἀγνωσίᾳ
5 μόνῃ περιληπτῶν, ὡς μηδ' ἀπ' αὐτῆς τῆς τῶν σχημάτων θέας
τὸ σαφὲς κεκτημένων καὶ εὐλήπτων, ἅτε μὴ πᾶσιν ὄντων
εὐκόλων τε καὶ γνωστῶν, μήτε μὴν πρὸς κατασκευὴν καὶ
τεκτόνευσιν εὐχερῶν, μόνων δὲ τῶν ταῦτα ἐξευρηκῶν καὶ
10 συγγεγραφεκῶν μηχανικῶν εἰς τὴν τούτων ἐξάπλωσιν καὶ
σαφήνειαν δεομένων· οἷον τὰ Ἀπολλοδώρου ἰπρὸς Ἀδριανὸν Wes 198
αὐτοκράτορα συνταχθέντα Πολιορκητικά, τὰ Ἀθηναίου πρὸς
Μάρκελλον ἐκ τῶν Ἀγησιστράτου καὶ ἐτέρων σοφῶν πρὸς
πολιορκίαν ἐκτεθέντα ὑπομνήματα, τὰ Βίτωνος πρὸς Ἄτταλον
15 Περὶ Κατασκευῆς Πολεμικῶν Ὀργάνων ἐκ διαφόρων
συλλεγέντα προγενεστέρων μηχανικῶν (. . .) βελοποιϊκά, καὶ
τὰ πρὸς πολιορκίαν ἀντιμηχανήματα φυλακτικά τε καὶ
δαιτητικά, ἐπὶ τε συστάσει καὶ ἀλώσει πόλεων διάφορα
παραγγέλματα. Ταῦτα κατὰ τὴν πάλαι ἢ συνταχθεῖσαν τῶν f. 1v
ἀνδρῶν καθολικὴν τεχνολογίαν, ὡς τοῖς πολλοῖς νῦν
20 ἀπεξενομένα πάντῃ καὶ δυσδιάγνωστα, διὰ τε τὴν ἐκ τοῦ
χρόνου παραδραμοῦσαν λήθην, ἀλλ' ὅτι καὶ ἀσυνήθη κοινοῖς
τυγχάνει λόγοις τὰ τῶν ἐπιστημῶν ὀνόματα, τῇ παρουσίᾳ βίβλῳ
μὴ ἐντάξει πρέπον ἐκρίναμεν· ὡς ἂν μή, τῆς ἐπιπολαζούσης ἐν
αὐτοῖς ἀσαφείας τὸν νοῦν ἀντιπερισπώσης πρὸς ἑαυτήν, καὶ

1: 21–22 ἀσυνήθη – ὀνόματα: cf. Apollod. 138:14–15.

Tit. ΠΑΡΑΓΓΕΛΜΑΤΑ ΠΟΛΙΟΡΚΗΤΙΚΑ Sch: om. VB: Ἑρῶν(ος) προοίμ(ιον) add. m. rec. V (s. 14–15 ? v. Dain, 13); 1605 *Heronis Poliorctica* add. m2. rec. V (? A.D. 1650 Allatii, Dain, 33): ΠΟΛΙΟΡΚΗΤΙΚΑ Wes ἢ 1: 4 ἀγνωσίᾳ VBP: ἐννοία marg. ms. Lond. add. 15276: εὐγνωσίᾳ Mar: διαγνωσίᾳ Wes ἢ 4–5 ἀγνωσίᾳ μόνῃ VB: εὐγνωμοσύνη Sch ἢ 5 περίληπτον (sic) Mar ἢ 6 εὐλήπτων Mar ἢ 15 < . . . > Sch

<Instructions for Siege Warfare>

1. Everything about siege machines is difficult and hard to understand, either because of the intricacy and inscrutability of their depiction, or because of the difficulty of comprehending the concepts, or, to say it better, because of their incomprehensibility to most men; perhaps they are comprehensible only through <mystical> “unknowing.” For the <machines> do not obtain clarity and comprehensibility even from looking at the drawings of them, since these are neither easy nor understandable for all, nor indeed readily useful for construction and carpentry. The engineers alone who have invented and described these <machines> are required for explanation and clear knowledge of them. For example, the *Siege Machines* compiled by Apollodorus for the emperor Hadrian; the commentaries on siege warfare by Athenaeus for Marcellus, extracted from the works of Agesistratus and other skillful men; also those by Biton for Attalus *On the Construction of War Engines*, collected from the works of different earlier engineers; < . . . > artillery construction, and defensive and provisioning countermeasures against siege warfare, different instructions for the protection and capture of cities. These we have judged appropriate not to insert in the present volume according to the general systematic method compiled by men long ago (for this is wholly foreign now to most men and difficult to understand, because of the oblivion that comes with the passage of time, but also because the scientific terms are not familiar to the common speech) lest, with the obscurity that predominates in these <works> diverting the <reader’s> mind to

25 περὶ τὴν τῶν σαφῶν τις ἀτονήση διάγνωσιν. Μόνα δὲ τὰ
 Ἀπολλοδώρου, ἅπερ εἰς τέλος, διασαφήσαντες δι' ἐπεργασιῶν
 καὶ ἐπενθυμημάτων συνεπεράναμεν, πλείστα καὶ αὐτοὶ
 σύμφωνα προσευρόντες καὶ παραθέμενοι.

30 Ὅσα δ' ἐκ τῶν λοιπῶν σποράδην ἰ συνελεξάμεθα εὐγνώστα Wes 199
 καὶ πρὸς ἀλήθειαν εὐκατάληπτα, “κοινῆς ἐννοίας ἀξιώματα”
 κατὰ Ἀνθέμιον ὄντα καὶ ἀπὸ μόνου προβλήματος καὶ
 σχηματισμοῦ καταλαμβάνεσθαι δυνάμενα, μηδεμιᾶς
 διδασκαλίας ἢ ἐρμηνείας δεόμενα, ἰδιωτεῖα λέξεων καὶ
 35 ἀπλότητι λόγου ὑφ' ἡμῶν καὶ αὐτὰ μεταποιηθέντα πρὸς τὸ
 σαφέστερον, ὥστε παρὰ τῶν τυχόντων εὐκόλως καὶ
 τεκτονεύεσθαι καὶ κατασκευάζεσθαι, τοῖς τοῦ Ἀπολλοδώρου
 καὶ ταῦτα συμπλέξαντες, σὺν τοῖς σχήμασιν ἀκριβῶς
 διορισάμενοι, κατετάξαμεν, εἰδότες ὅτι δύναται καὶ μόνος
 40 σχηματισμὸς καλῶς διορισθεὶς τὸ περὶ τὴν κατασκευὴν ἢ
 σκοτεινὸν καὶ δύσφραστον κατάδηλον ἀπεργάζεσθαι. f. 2

2. Χρεία δέ ἐστι τῶν εἰς πολιορκίαν μηχανημάτων· χελωνῶν
 διαφόρων τε καὶ ἑτεροσχήμων, οἷον ὀρυκτριδῶν, χωστρίδων,
 κριοφόρων, προτρόχων, καὶ τῶν νῦν ἐκ πλοκῆς ἐφευρεθεισῶν
 ἐλαφροτάτων λαισῶν, πρὸς δὲ τὰ κυλιόμενα βάρη σφηνοειδῶν
 5 ἐμβόλων, γερροχελωνῶν, καὶ ξυλίνων πενταπηγῶν τριβόλων,
 κριῶν συνθέτων τε καὶ μονοξύλων, ξυλοπυργίων φορητῶν
 εὐπορίστων, κλιμάκων συνθέτων τε καὶ ἐλαφροτάτων εἴδη
 διάφορα, προφυλακῆ δὲ πάλιν καὶ πρὸς τὰ εἰς ὕψος αἰρόμενα
 βάρη καὶ πρὸς τὰ ὑπὸ ἰ τῶν τυροβόλων ἀναπτόμενα, σκοποὶ εἰς Wes 200
 10 καταθέρησιν τῶν ἔνδον, διορυγαὶ τειχῶν διαφόρων διάφοροι,
 διαβάθραι πρὸς παντοίας τάφρους εὐμήχανοι, δίχα κλιμάκων
 μηχαναὶ τοῖς τείχεσιν ἐπιβαίνουσαι, πολιορκητήρια παραλίων
 πόλεων ἀπαράπτωτα, πολλῶν ὄχλων κατὰ τάξιν ἀθροαὶ ἐπὶ
 ποταμῶν διαβάσεις. Ταῦτα κατασκευάζειν κατὰ τοὺς πάλαι
 15 ἀρχιτέκτονας εὐπόριστα τῇ ὕλῃ, ποικίλα τοῖς σχήμασιν,
 ἐλάχιστα τοῖς μέτροις, ἐλαφρὰ τοῖς βάρεσιν, ὑπὸ τυχόντων

40 δύσφραστον κατάδηλον: cf. Ath. Mech. 39:1. 2: 1–19 Χρεία – εὐδιάλυτα: cf. Apollod. 138:18–139:8.

2: 1 τῶν VB: τούτων Wes (cf. Apollod. 138:18)

itself, one be too exhausted for comprehension even of what is clear. Having clarified only the works of Apollodorus as it were in toto with additional elaborations and secondary arguments, we have drawn our conclusions, finding and adding ourselves numerous concordant <items>.

Everything we have collected here and there from the remaining <writers> is easy to know and apprehend truthfully, "axioms of common intuition" as Anthemios says, and capable of being comprehended from the problem alone and the illustration; they require no instruction or interpretation. We have recast these with common diction and simplicity of style for greater clarity so that <machines> can be both carpentered and constructed easily by anyone. After weaving this <material> also into the works of Apollodorus we have arranged it with the drawings, giving these precise definition, knowing that even an illustration alone, when well defined, is able to render quite clear aspects of construction that are obscure and difficult to express.

2. There is a need of machines for conducting a siege: different types and forms of tortoises, such as excavating tortoises, filler tortoises, ram-carrying tortoises, tortoises with wheels in front, and plaited *laisai*, recently invented and very light, wedge-shaped beak <tortoises> to protect against heavy rolling objects, wicker tortoises; and wooden caltrops 5 *pecheis* in height; rams both composite and of a single piece of wood; portable wooden towers, which are easy to procure; different forms of ladders, composite and very light; also protection against heavy objects that are raised high <to drop> and against <flames> ignited by incendiaries; scout-ladders for viewing things inside <cities>; different tools for digging through different kinds of walls; drop-bridges useful for all types of ditches; machines for mounting walls without ladders; siege machines that do not fall over for use against coastal cities; bridges for en masse river crossings of large numbers of men in good order. <It is necessary> to construct these following the ancient master builders, of materials that are easy to procure, varied in form, as small as possible, light in weight, able to

20 τεχνιτῶν ταχέως γίνεσθαι δυνάμενα, εὐδιόρθωτα, δυσεπιβούλευτα, εὐμετάγωγα, ἀσφαλῆ, δυσκάτακτα, εὐσύνθετα πρὸς τὴν χρεῖαν ὄντα καὶ εὐδιάλυτα. Ταῦτα δὲ ἢ πάντα, στρατηγικὴν ἐπιστήμην ὡς πρὸς πολιορκίαν ῥαδίως ἐφοδιάζειν δυνάμενα, ἐν τῆδε τῇ δέλτῳ πρὸς τε κατασκευὴν καὶ χρεῖαν καθεξῆς προϊόντες, κατὰ τάξιν ἀναγράψαντες ἐξεθέμεθα.

3. Καὶ μὴ τις λέξων ἐξονυχιστής, συνθήκην ἀττικίζουσιν ἐρευνῶν ἢ δεινότητα λόγου, κάλλος τε καὶ ἄρμονίαν καὶ σχημάτων εὐρυθμίαν, περὶ τὸ ἰδιωτικὸν καὶ ὑπτίον ἡμᾶς εὐθύνη, τῶν πάλαι σοφῶν ἀκούων ὅτι ὁ πρὸς πολιορκίαν
5 γινόμενος ἅπας λόγος σαφηνείας τε καὶ τῆς δεούσης ἐπιδειῖται συντομίας, ἔστιν δὲ ὅτε καὶ ταυτολογιῶν καὶ ἐπαναλήψεων καὶ ἐπενθυμημάτων πρὸς κατάληψιν τῶν τε διανοημάτων καὶ πράξεων, διαλεκτικῶν δὲ παραγγελμάτων ἢ τῶν τούτοις ἀντιστρόφων ἀνοίκειος ἢ τυγχάνει· εἰδὼς δὲ ὅτι καὶ Πλωτίνος ὁ
10 μέγας “ἔγραφεν,” ὡς φησὶν ὁ πολὺς ἐν σοφίᾳ Πορφύριος, “οὔτε εἰς κάλλος ἀποτυπούμενος τὰ γράμματα, οὔτε εὐσήμως τὰς συλλαβὰς διαιρῶν, οὔτε τῆς ὀρθογραφίας φροντίζων, ἀλλὰ μόνου τοῦ νοῦ καὶ τῶν πραγμάτων ἐχόμενος.” Τριττὰ γὰρ τὰ ὄντα ἠπίστατο, ἐν τε φωναῖς νοήμασί τε καὶ πράγμασι· καὶ τὸν
15 μὲν περὶ τὰς φωνὰς σφαλλόμενον μηδὲν διασύρεσθαι, ὡς οὐδὲν τὸ νόημα ἢ τὸ πρᾶγμα λυμαινόμενον· τὸν δὲ περὶ τὰ νοήματα ἀμαρτάνοντα πικρῶς διελέγχεσθαι, ὡς ἢ ἀδιανοήτως φθεγγόμενον· πολλῶ δὲ ἄρα τὸν περὶ τὰ πράγματα τυφλώττοντα
20 κατὰ διάθεσιν ἐπίπτοντα ἄγνοιαν, ἦντινα διπλῆν ὁ Πλάτων καλεῖ, διὰ τὸ εἰδέναι μὲν ὅτι γινώσκει, μὴ ἐπίστασθαι δὲ ὅτι ἄγνοεῖ. Ἀλλὰ καὶ ὁ ἱστοριογράφος Καλλισθένης φησίν, “δεῖν τὸν γράφειν τι πειρώμενον μὴ ἀστοχεῖν τοῦ προσώπου, ἀλλ’

Wes 201

f. 3

3: 4-9 ὁ - τυγχάνει: cf. Ath. Mech. 7:4-6. 10-13 ἔγραφεν - ἐχόμενος: cf. Porph. *Plot.* VIII. 13-14 Τριττὰ - ὄντα: cf. Olymp. Phil., *Proll.* 18:25-27, Elias Phil., *In Cat.* 129:9-11. 20-22 διπλῆν - ἄγνοεῖ: cf. Pl. *Sph.* 229b, *Chrm.* 166d. 22-24 ὁ - θεῖναι: cf. Ath. Mech. 7:1-4.

3: 13 Post τὰ add. ἀμαρτήματα Mar ἢ 21 Post μὲν add. οἶεσθαι Sch ἢ 22 δεῖν Wes (cf. Ath. Mech. 7:2): δεῖν VB

be made quickly by any craftsman, easy to repair, difficult to damage, easy to transport, secure, difficult to break, easy to assemble for use and to disassemble. All these <devices>, which can easily supply knowledge for generals on conducting sieges, we have set forth in this book for both construction and use, proceeding in order and recording them in sequence.

3. And let no scrutinizer of diction, searching for Attic composition or forcefulness of style, and beauty and harmony and gracefulness of <rhetoical> figures, fault us for our commonplace and flat writing, after hearing from the wise men of the past that all writing on siege warfare requires clarity and the necessary conciseness, but sometimes also repetitions and reiterations and secondary arguments for comprehension of the concepts and operations, but that it is not suited to dialectic precepts or their <rhetoical> counterparts and knowing that even the great Plotinus “has written,” as the most wise Porphyry says, “without forming his letters calligraphically, not dividing syllables clearly, nor being concerned for correct spelling, but concerned only with the concept and the things.” For he knew that reality is tripartite: words, concepts, and things. And the one who errs regarding words is not disparaged, as he does not harm the concept or the thing; but the one missing the mark on concepts is severely reproached for speaking incomprehensibly; but the one who is blind to things is then especially condemned, as a fool and writer of falsehoods. For this one falls into the ignorance by disposition that Plato calls double, “knowing that one knows and not understanding that one is ignorant.” But the historian Kallisthenes says: “It is necessary for one who undertakes to write something not to depart from his personality, but to suit the

οικείως αὐτῷ τε καὶ τοῖς πράγμασι τοὺς λόγους θεῖναι” [τῆς
 25 σοφίας]. Τουτὶ γὰρ ἂν τις εἰς πραγμάτων λόγον ὠφεληθεὶς | Wes 202
 ἀπέλθοι, ἢ ἐκ τῶν Φιλολάου καὶ Ἀριστοτέλους, Ἴσοκράτους
 τε καὶ Ἀριστοφάνους καὶ Ἀπολλωνίου καὶ τῶν παραπλήσια
 ἐκείνοις γεγραφότων· νεωτέροις μὲν γὰρ φιλομαθοῦσιν οὐκ
 30 ἄχρηστα πρὸς ἕξιν τοῦ στοιχειωθῆναι φανήσονται, τοῖς δὲ
 βουλομένοις ἤδη τι πράττειν πόρρω παντελῶς ἂν εἴη καὶ
 ἀπφικισμένα τῆς πραγματικῆς θεωρίας. Ὅθεν καὶ Ἡρων ὁ
 μαθηματικός, συνεῖς τὸ Δελφικὸν ἐκείνο παράγγελμα τὸ
 ὑπομνησκον ἡμᾶς χρόνου φείδεσθαι καὶ ὅτι τὰ τοῦ καιροῦ
 35 μέτρα δεῖ εἰδέναι ὡς ὑπάρχοντος ὅρου (τῆς σοφίας), τὸ μέγιστον
 καὶ ἀναγκαιότατον μέρος τῆς ἐν φιλοσοφίᾳ διατριβῆς καὶ μέχρι
 τοῦ νῦν παρὰ πολλῶν ζητούμενον περὶ ἀταραξίας ὑπάρχειν
 ᾗτο, καὶ μηδέποτε διὰ τῶν λόγων τέλος ἕξειν ἔλεγεν. Μηχανικὴ
 40 δέ, τὴν ἐν λόγοις δι’ ἔργων ὑπερβᾶσα διδασκαλίαν, πάντας || f. 3v
 ἀνθρώπους ἐδίδαξεν ἀταράχως ζῆν ἐπίστασθαι δι’ ἐνὸς αὐτῆς
 μέρους τοῦ κατὰ τὴν βελοποιίαν καλουμένου· ὡς μήτε ἐν
 εἰρηνικῇ καταστάσει ταράττεσθαι ποτε ἐχθρῶν καὶ πολεμίων | Wes 203
 ἐφόδους μήτε πολέμου ἐνστάτος, εἰ ἐν παντὶ χρόνῳ καὶ
 καταστήματι σὺν τοῖς σκευαζομένοις τροφίμοις ἔν τε
 πολιορκίαις καὶ στρατεύμασιν ὀλιγαρκέσιν ἐπιμονιδίους

25–31 Τουτὶ – θεωρίας: cf. Ath. Mech. 4:13–5:7. 32–33 τὸ – φείδεσθαι: cf. Ath. Mech. 3:2–4. 33–34 τὰ – σοφίας: Ath. Mech. 4:12–13. 34–43 τὸ – καταστήματι: cf. Hero Bel. 71–72. 44–45 ἐπιμονιδίους – φαρμάκοις: cf. Philo Mech. 88:29.

24 αὐτῷ Wes (cf. Ath. Mech. 7:3): αὐτοῦ VBP: αὐτῷ Mar || 24–25 τῆς σοφίας secl. Mar || 25 Τουτὶ VBP (cf. Ath. Mech. 4:13): τούτῳ Mar || Post λόγον add. πλέον Mar || 34 δεῖ Mar: δεῖν VBP || ὅρου Mar (cf. Ath. Mech. 4:13): ὀόρου VBP || τῆς σοφίας add. Mar || 44 ἐπιμονιδίους: in marg. VB: Συντίθεται δὲ τοῦτο τὸ ἐπιμονίδιον φάρμακον ἀφεψηθείσης σκίλλης καὶ πλυθείσης ὕδατι καὶ ξηρανθείσης κατακοπέσης τε εἰς λεπτότατα, καὶ μετὰ ταῦτα παραμιχθέντος εἰς αὐτὴν σήσαμον τοῦ ε’ μέρους, μήκωτος ὡς ιε’, καὶ πάντων τούτων λεανθέντων ἐν τῷ αὐτῷ ὡς βελτίστῳ μέλιτι φυράσαντα (φυράσαντι V; cf. Philo Mech. 88:37), διελεῖν ὅσον εἰς ἐλαίας τὰς μεγίστας γινομένας. Καὶ τούτων ἐν μὲν περι β’ ὥραν, ἐν δὲ περι ι’ ἀναλίσκοντες, οὐθὲν ὑπὸ λιμοῦ πάθειεν δεινόν. Ἄλλη σύνθεσις φαρμάκου συντιθεμένη τοῦτον τὸν τρόπον. Λαβῶν σήσαμον Ἀττικὸν ἡμίεκτον καὶ μέλιτος ἡμίχουν καὶ ἐλαίου κοτύλην καὶ χοίνικα ἀμυγδάλων γλυκέων λελεπισμένων, φρύξαντες τὸν σήσαμον καὶ τὰ ἀμύγδαλα, καταλέσαι καὶ σείσαι· εἶτα τὰς σκίλλας περιλείσαντα καὶ τὰς ρίζας καὶ τὰ πέταλα ἀποτεμόντα καὶ διελόντα μικρά, εἰς θυίαν (θυίαν V; cf. Philo

words both to himself and to things." For in this way one might come off with benefit in the discussion of things, more than from the <works> of Philolaus and Aristotle, Isocrates and Aristophanes and Apollonius and those who have written like them. For on the one hand, for the young who are eager to learn, these will not seem useless for the acquisition of basic principles; but for those wishing to accomplish something beyond that, they would be completely distant and remote from practical science. Whence Heron the mathematician, understanding that Delphic dictum reminding us to be sparing of time and that it is necessary to know the measures of time, as there is a limit on wisdom, considered the largest and most necessary part of the study of philosophy and the one investigated even to this day by the greatest number to be that concerning tranquility; and he said that it will never achieve a conclusion by argument, but that mechanics, which surpasses teaching by argument through actions, has taught all men to know how to live without anxiety through one of its branches, that called artillery construction; and in conditions of peace and war never to be anxious about attacks of domestic or foreign enemies, provided that at all times and in all conditions, with nourishment prepared for both sieges and expeditions, minimum requirements called long-lasting¹

¹ [Marginal scholion] This long-lasting ration is compounded of squill, boiled, washed with water, dried and cut very thin; then sesame is mixed into it, one fifth part, and poppy one fifteenth, and all this is crushed and the best honey kneaded into it. Divide this into pieces the size of large olives. If one uses one of these at the second hour, another at the tenth, he will not be severely affected by hunger.

Another compound ration is put together as follows. Take an Attic *hemiekton* of sesame and a *hemichoun* of honey and a *kotule* of oil and a *choinix* of peeled sweet almonds; roasting the sesame, grind and sift the almonds, peel the squill and cut away the roots and leaves, separating it into small pieces, put it in a mixing bowl, pound it very smooth. Next pound evenly an equal amount of the pounded squill with honey and olive oil and, pouring it into a pot, boil it placed on the coals.

When it begins to boil adding the sesame and almonds, stir with a stick until everything is homogenized. And when it is quite stiff, taking it out divide it into small morsels. Someone taking this, one in the morning and one in the afternoon, will have sufficient sustenance. This ration is good also for expeditions; for it is sweet and filling and causes no thirst.

45 λεγομένοις φαρμάκοις καί τισι σμικροτάτοις βρώμασιν
 πλησμίσις ἀδιψίαν ἐμποιοῦσιν, καὶ τὴν τῶν βελοποιϊκῶν
 ὀργάνων μάλιστα ποιούμεθα πρόνοιαν. Καὶ ἐπεὶ οἱ τὰ πρὸς
 πολιορκίαν καθ' ὅλου ἐπιστάμενοι ὀρθῶς καὶ τὰ ἀντικείμενα
 ἴσασι, τῶν δὲ ἀντικειμένων μία ἐστὶν ἐπιστήμη, οἱ διὰ
 50 μηχανικῆς ἄρα παρασκευαστικῆς τε ὀλιγαρκοῦς πανημερίου
 βρώσεως καὶ κοινῆς ἀπάσης ἐπ' εὐταξίᾳ διαίτης πολιορκίαν
 συνιστᾶν ἢ λύειν δυνάμενοι ἀεὶ ἐν ἀταραξίᾳ διάξουσιν. Οὐκ
 ἀπεικὸς οὖν πρὸς τοὺς πολυγραφοῦντας καὶ εἰς οὐκ ἀναγκαίους
 λόγους τὸν χρόνον καταναλίσκοντας, ἀνθηρολεκτοῦντάς τε
 55 πρὸς (τὸ) κενοὺς λόγους ἄψυχα ἐκφράζοντας κοσμεῖν καὶ ζῶα
 αἰνοῦντας ἢ ψέγοντας οὐ κατ' ἀξίαν δι' ἔμφασιν τῆς ἑαυτῶν
 πολυμαθείας, καὶ Κάλανον τὸν Ἰνδὸν εἰρηκέναι· “Ἑλλήνων
 φιλοσόφοις οὐκ ἐξομοιοῦμεθα παρ' οἷς ὑπὲρ μικρῶν καὶ
 ἀφελῶν πραγμάτων πολλοὶ καὶ δεινοὶ ἀναλίσκονται λόγοι·
 60 ἡμεῖς γὰρ ὑπὲρ τῶν μεγίστων καὶ βιωφελεστάτων ἐλάχιστα καὶ
 ἀπλᾶ, ὡς πᾶσιν εὐμνημόνευτα, παραγγέλλειν εἰώθαμεν.” ἢ
 4. (Τ)ὸν ὑπὸ τῆς ἄνω προνοίας ἐπ' εὐσεβείᾳ συντηρούμενον
 στρατηγικώτατον ἄρχοντα, τῇ κελεύσει καὶ γνώμῃ καὶ εὐβουλίᾳ
 τῶν θειοτάτων αὐτοκρατόρων ὑπείκοντα, καὶ δυσμενεῖς καὶ
 ἀποστάτας πολιορκεῖν μέλλοντα, τὰς τῶν πόλεων θέσεις
 5 ἀκριβῶς διερχόμενον ἐπισκέπτεσθαι χρὴ πρότερον, καὶ τὴν τοῦ
 ἰδίου λαοῦ πρὸ πάντων ἀβλαβῆ ποιούμενον φύλαξιν τῆς

46 πλησμίσις – ἐμποιοῦσιν: cf. Philo Mech. 89:9–10. 46–47 καὶ – πρόνοιαν: cf. Hero *Bel.* 72. 47–49 Καὶ – ἴσασι: cf. Ath. Mech. 39:1–5. 49 τῶν – ἐπιστήμη: cf. Arist. *Tōp.* 163a:2–3. 52 ἀεὶ – διάξουσιν: cf. Hero *Bel.* 71–73. 52–54 Οὐκ – καταναλίσκοντας: cf. Ath. Mech. 4:9–10. 56–57 ἔμφασιν – πολυμαθείας: cf. Ath. Mech. 4:10–11. 57–61 Κάλανον – εἰώθαμεν: Ath. Mech. 5:8–11.

Mech. 88:49) ἐμβαλόντα, τρίψαι ὡς λειότατα. Μετὰ δὲ ταῦτα τῶν τετριμμένων σκιλλῶν (τὸν τετριμμένον σκίλον V; cf. Philo Mech. 88:50–51) ἴσον τῷ μέλιτι τρίψαι ὁμαλῶς ἅμα τῷ ἐλαίῳ καὶ ἐγγέοντας εἰς χύτραν ἐψεῖν ἐπιθέντας ἐπ' ἀνθρακίᾳς. “Ὅταν δὲ ἄρξηται ζεῖν, παρεμβalόντα τοῦ σησάμου καὶ τῶν ἀμυγδάλων ἅμα ζύλω διακινεῖν, μέχρις ἂν ἅπαντα ἐνωθῆ. “Ὅταν δὲ γένηται στερεὸν ἰσχυρῶς, ἀφελόντα διελεῖν εἰς ψωμοὺς μικροῦς· καὶ ἓνα πρωί, ἓνα δεῖλης, ἀναλίσκων τις ἱκανὴν ἔχει τροφήν. Τυχᾶνει δὲ καὶ πρὸς στρατιᾶς τοῦτο τὸ φάρμακον ἀγαθόν· ἡδὺ γάρ ἐστι καὶ πλήσιμον, καὶ δίψαν οὐκ ἐμποιεῖ. ἢ 55 τὸ addidi ἢ ἄψυχα Mar: ἀψύχοις VBP ἢ 56 οὐ κατ' ἀξίαν Mar: οὐκ ἀταξίαν VBP ἢ 60 βιωφελεστάτων Wes: βιωφιλεστάτων VB ἢ 61 Post εἰώθαμεν reliqua p. vac. V ἢ 4: 6 Post φύλαξιν ras. 4–5 litt. V

rations, and with certain very small amounts of food that is filling and does not cause thirst, we also especially have provision for artillery engines. And since those who are fully knowledgeable about the details of siege warfare also know how to defend against it correctly, and there is really one subject <composed> of these two opposites, they will always live then without anxiety, being able to mount or break a siege through the mechanical preparations, minimum daily food, and a common regimen completely in good order. And in opposition to those who write at length and spend time on unnecessary words, speaking in a flowery manner to the adornment of empty phrases that describe inanimate objects and praise or censure living creatures, not appropriately, <but> to stress their own learning, the Indian Kalanos has not unfairly said: “we are not like the philosophers of the Hellenes, among whom many and awesome words are lavished on small and simple things; for we are accustomed to recommend the least and simplest about those things that are the greatest and most important to life, as this is the easiest way for all to remember them.”

4. The most competent military commander, kept safe by Providence above because of his piety, and obedient to the command and judgment and good counsel of our most divine emperors, when he is about to besiege the enemy and rebels, must first, by going about <himself>, precisely observe the position of the cities; and having provided for the secure protection of his own

πολιορκίας ἀπάρχεσθαι, πρὸς ἄλλους μὲν τόπους καστρομαχεῖν ἐνδεικνύμενον, εἰς τὸ ἐκεῖσε τοὺς ἐχθροὺς ἀπατωμένους παρασκευάζεσθαι, καὶ πρὸς ἄλλους εἰσφέρειν τὰ μηχανήματα, 10 τὴν δὲ προσβολὴν πρὸς τὰ σαθρότερα τῶν τειχῶν ἐκ διαδοχῆς στρατιωτικῶν ταγμάτων κατὰ συνέχειαν ποιεῖσθαι, σὺν πολλῶ θορόβῳ τοὺς ἔνδον περισπῶντα καὶ σάλπιγγας νύκτωρ ἐπὶ τὰ ὀχυρώτερα μέρη ἀνίεσθαι, ἵνα ὑπολαμβάνοντες οἱ πλείστοι ταῦτα ἀλίσκεσθαι, ἀπὸ τῶν μεταπυργίων μετὰ τῶν ἄλλων 15 ἐκφύγωσι.

5. Καὶ εἰ μὲν ἐφ' ὑψηλῶν λόφων ἢ κρημνῶν δυσβάτων ὧσιν αἱ πόλεις κείμεναι, δεῖ τὰ ἄνωθεν ἀπὸ τῶν ἐναντίων ἐπικυλιόμενα | παραφυλάττεσθαι βάρη, ἅτινά εἰσι || λίθοι Wes 205
στρογγύλοι, κίονες, τροχοί, σφόνδυλοι, ἄμαξαι τετράτροχοι f. 5
5 φορτίοις βεβαρημένοι, ἀγγεῖα ἐκ πλοκῆς διάφορα κόχλακος ἢ γῆς πεπιλημένης γέμοντα, καὶ οἷα τὰ ἐκ σανίδων κυκλοτερῶς συνηρμοσμένα καὶ δεσμοῖς ἔξωθεν περιειλημμένα τὰ πρὸς ὑποδοχὴν οἴνου γινόμενα ἐλαίου τε καὶ παντὸς ὑγροῦ· ἄλλα τε ὅσα πρὸς ἄμυναν ἐνδεχόμενόν ἐστι παρὰ τῶν ἐναντίων 10 ἐπινοεῖσθαι.

6. Καὶ χρῆ πρὸς ταῦτα ἀντιμηχανωμένους τριβόλους κατασκευάζειν ξυλίνους πενταπήχεις, ὑπὸ τινων λαβδαραίας καλουμένους, πάχους ἐκάστου σκέλους τὸν γῦρον ἔχοντος ὡσεὶ ποδῶν δύο, ὥστε μὴ θραύεσθαι ἢ διακλᾶσθαι, ἀλλὰ ἀντέχειν 5 πρὸς τὰ καταφερόμενα βάρη· ἱκανοὺς δὲ τῷ πλήθει κατασκευάζειν αὐτούς, ἵνα τριπλῆ ἢ καὶ τετραπλῆ ἢ τούτων γίνηται θέσις· οὕτως γὰρ τὰ δυσανάφορα καὶ δυσχερῆ τῶν τόπων περιορίζοντα δυνατὸν ἐστὶν ἐκτὸς βέλους ἀκινδύνως ἀνέρχεσθαι· ἢ γὰρ τῶν λίθων βιαία καταφορὰ ἐπὶ τῇ τῶν 10 τριβόλων ἀναστροφῇ ἐνεχθεῖσα ἡρεμήσει.

7. Ἔστι δὲ καὶ κατ' ἄλλον τρόπον τὴν ἐκ τῶν κατερχομένων παραφυλάξασθαι βλάβην· ἐκ γὰρ τῆς ὑπωρείας κάτωθεν Wes 206

4: 7-9 πρὸς - μηχανήματα: cf. Philo Mech. 98:14-17. 10-15 τὴν - ἐκφύγωσι: cf. Philo Mech. 98:45-52. 5: 1-6 Καὶ - γέμοντα: cf. Apollod. 139:9-12. 6: 1-10 τριβόλους - ἡρεμήσει: cf. Ath. Mech. 38:2-9.

6: 8 περιορίζοντας Mar

host above all, begin the siege, first appearing to attack the fortifications in certain locations, in order that the enemy be tricked into making their preparations there, and then deploying machines against other places. He should continuously attack the weaker parts of the walls with relays of *tagmata* of soldiers, with loud noise distract those inside and sound trumpets by night at the stronger parts, in order that the majority, assuming that these parts are captured, might flee from the curtain walls with the others.

5. And if the cities are situated on high hill crests or impassable crags, it is necessary to guard against heavy objects being rolled down from above by the enemy. These are: round stones, columns, wheels, column drums, heavily loaded four-wheeled wagons, different plaited containers full of gravel or compacted earth, and the kind <made> of boards fitted together in a circle and surrounded with bands on the outside, which are for storage of wine and oil and every liquid, and other things such as can be devised for defense by the enemy.

6. And it is necessary when devising countermeasures against these to construct wooden caltrops 5 *pecheis* tall, which some call *labdaraiai*, each leg having the circumference of about 2 *podes* thick, so as not to be shattered and broken, but to withstand the heavy descending objects; and to construct these in sufficient number so that they can be placed three and four deep. For by thus surrounding the hard to reach and difficult places, it is possible to move upward without danger outside missile range. For the forceful rush of the stones will be stilled when checked by the resistance of the caltrops.

7. One can guard in yet another way against harm from objects coming down. For beginning from below from the foot of the

ἀρχομένους πλαγίας ὀρύσσειν δεῖ τάφρους, καὶ πρὸς ἢ τινα μέρη
 τῶν τειχῶν ἀφορᾶν καὶ ἀνέρχεσθαι, βάθος ἔχουσας ὡσεὶ ποδῶν
 5 πέντε, καὶ ἓνα τοῖχον ὀρθὸν τὸν ἐκ τοῦ αὐτοῦ ὀρύγματος ἐπ’
 ἀριστερὰ ὄντα, πρὸς ὃν ἐπιφέρεται τὰ κυλιόμενα βάρη,
 προτείχισμα καὶ ἀσπίδα τῶν ἀνερχομένων γινόμενον. Τὸν δὲ
 προορυχθέντα τόπον ἀσφαλίζεσθαι τοὺς ὀρύσσοντας οὕτως·
 ξύλα ὡς ἐξάπηχα ἢ νεάκια κάτωθεν ὀξύνοντας ὡς πασσάλους
 10 πρὸς τὸν ῥηθέντα ἐκ τοῦ χώματος ὀρθὸν τοῖχον ἐπ’ ἀριστερὰ
 πρὸς τὸ ἀντέχειν πηγνύειν, λελοξευμένα πρὸς τὴν καταφερῆ
 τοῦ λόφου κλίσιν· καὶ σανίδας ἐπ’ αὐτὰ ἔξωθεν ἐπιθέντας,
 κλάδους δένδρων ἀπαγκαλίζοντας περιδεσμεῖν· καὶ τὴν
 ὀρυσσομένην ἅπασαν ὕλην ἐκεῖσε ἀπορρίπτοντας ὁδοὺς
 15 εὐθείας ἐξομαλίζειν πρὸς τὰς τῶν χελωνῶν ἀναβάσεις. Τὰς δὲ
 προσφερομένας χελώνας ἐμβόλους κατὰ πρόσωπον γίνεσθαι,
 τουτέστι σφηνοειδεῖς ἐκ τριγώνων ἢ πενταγωνοειδῶν βάσεων
 συνεστῶσας πρὸς ὀξεῖαν κατ’ ἔμπροσθεν γωνίαν, ἐκ δὲ τοῦ
 κάτω πλάτους πρὸς ὕψος ἀνερχομένας καὶ μέχρι τῆς κατὰ
 20 κορυφὴν ῥάχεως εἰς ὅξυ προΐούσας, ὁμοιουμένας ἔμπροσθεν
 πλοίων πῤῥαίς πρὸς γῆν ἐπισκηφθέντων ὡς τῶν καλουμένων ἢ
 τοξικίων· μικρὰς δὲ αὐτὰς εἶναι καὶ πλείονας διὰ τὸ ταχέως
 καὶ εὐκόλως κατασκευάζεσθαι καὶ ὑπὸ ὀλίγων ἀνδρῶν εὐκόπως
 φέρεσθαι, λεῖα ξύλα ποδιαῖα περὶ ἢ τὴν βάσιν ἔχουσας, καὶ ἀντὶ
 25 τροχῶν ἢ λους σιδηροῦς διὰ τὸ τιθεμένας πρὸς τῆ γῆ πήγνυσθαι
 καὶ μὴ ὑπὸ τῆς ἐμβολῆς κατασύρεσθαι· ἔχειν δὲ καὶ πλάγιον
 ξύλον ἐκάστην κατὰ μέτωπον, ὡσπερ ἐν τοῖς ῥυμοῖς ἔχουσιν αἱ
 ἄμαξαι, ἵνα ὑποστρέφουσιν αὐτὴν πρὸς τὸ καταφερὲς ἀντέχει
 καὶ ἐπιστηρίζη, καὶ μάλιστα ὅταν οἱ προσάγοντες αὐτὴν ἐπὶ τὸ
 30 ἀνωφερὲς ἀτονήσωσι καὶ πρὸς μικρὸν ἀναπαύεσθαι μέλλωσι.
 Συμβήσεται οὖν, ἢ τῆ τάφρω πλαγία οὔση ἐμπίπτοντα
 παραφέρεσθαι τὰ βάρη, ἢ τοῖς λοξοῖς πασσάλοις πλαγίαν
 ἔχουσι θέσιν ἐνσεῖοντα ἀπορραπίζεσθαι, ἢ τοῖς ἐμβόλοις
 ἐγκρούοντα πρὸς θάτερον μέρος παράγεσθαι, τὸ δὲ διὰ μέσου
 35 χωρίον τῆς πληγῆς ἀπαλλάττεσθαι.

f. 6

Wes 207

7: 3–35 πλαγίας – ἀπαλλάττεσθαι: cf. Apollod. 140:3–141:3.

7: 9 ἐξάπηχα Wes: ἐξάπηχα VBP: ἐξαπηχῆ Mar ἢ 21 ἐπισκηφθέντων Sch: ἐπισκυφθισεισῶν V: –ών B: ἐπὶ συνφισθεισῶν P: ἐπισυσφιγθεῖσαις Mar

slope it is necessary to dig ditches diagonally and to aim at and advance upward toward certain parts of the wall; the <ditches> should have a depth of about 5 *podes* and a single wall <that rises> vertically from the same excavation on the left side, against which the heavy rolling objects strike, as it is a rampart and shield for those advancing upward. The diggers should fortify the area already dug thus: sharpening at the bottom pieces of wood about 6 *pecheis* in length, or trunks of young trees, like stakes, affix them to the aforementioned vertical wall <made> on the left side from the excavated soil, to offer resistance; these stakes should be set on a slant corresponding to the downslope of the hill. And having placed boards on the outside of these <stakes>, bind them together by interweaving tree branches. And having thrown up there all the excavated material, level straight paths for the ascents of the tortoises. The tortoises being deployed should be beaked in front, that is, wedge-shaped, constructed from triangular or pentagonal bases to a sharp angle in front, but rising upward from the wide <area> below and proceeding to a sharp <angle> at the ridge on top, similar in front to the prows of ships set upside down on the ground, like the so-called *toxikia*. These <tortoises> should be small and numerous, because they are <then> quickly and easily constructed and readily carried by a few men, having smooth 1-*pous* pieces of wood around the base and iron nails instead of wheels, so that when set down they are fixed in the ground and not overturned by <any> impact. And each should have a diagonal piece of wood at the front, such as wagons have in their poles, so as to stop it and prop it up if it turns back downward, and especially whenever those who are pushing it uphill grow tired and are going to rest for a short time. It will follow, therefore, that the heavy objects, falling into the ditch which is diagonal, are diverted, or, striking against the slanted stakes which are in a diagonal position, are repelled, or hitting against the beaks are deflected to either side, but the midsection is spared the blow.

8. Βέλτιον δὲ προσάγειν καὶ τὰς λεγομένας γερροχελώνας, ἐλαφροτέρας τῶν ῥηθέντων ἐμβόλων καὶ ὁμοιοσχήμους οὔσας, κατασκευαζομένας ἐκ πλοκῆς ἰτείνων βεργῶν νεοτμήτων ἢ ἐκ μυρίκης ἢ φιλύρας, ὄξειας καὶ αὐτὰς κατὰ πρόσωπον οὔσας

5 ἄχρι τῆς κατὰ κορυφὴν ῥάχεως.

9. Τὰς δὲ καλουμένας λαίσας, ἐλαφροτάτας οὔσας, ἢ ἐκ πλοκῆς καὶ αὐτὰς ἀμπελίνων κλημάτων ἢ νεοτμήτων βεργῶν ἐν σχήματι τροπικῶν διὰ τάχους γινομένας, οὐ δεῖ πρὸς κατωφερεῖς καὶ κρημνώδεις εἰσφέρειν τόπους, μήπως ὄλεθρον τοῖς ἄγουσιν ἐμποιήσωσιν, ἀδυνατοῦσαι ἀντέχεσθαι πρὸς τὰ ὑπέρογκα τῶν βαρῶν· χρᾶσθαι δὲ αὐταῖς μᾶλλον, ὅταν ἐν ἐπιπέδοις καὶ ὁμαλοῖς τόποις ὧσιν αἱ πόλεις κείμεναι· τότε γὰρ ἔσονται εὐχρηστοί. |

f. 6v

5

Wes 208

10. Ὁ δὲ πρὸς τὴν καστρομαχίαν ἀνερχόμενος λαὸς ἀκολουθήσει πρὸς τὰ πλάτη τῶν ἐμβόλων φυλαττόμενος ἥτοι τῶν χελωνῶν ὀπισθεν, καὶ ταῖς ἀμπελοχελώναις σκεπόμενος διὰ τε τὰς τοξείας καὶ τὰς σφενδονήσεις. Εἰσὶ δὲ τοιαῦται· ξύλα

5 βασταζουσιν οἱ ὀπλίται ὀρθά, πρὸς ὕψος ἄνισα ὄντα ἐν παρ' ἑν, πάχος ἔχοντα γυρόθεν ὡσεὶ δακτύλων δώδεκα, κατὰ δὲ πέντε πόδας πρὸς ἕτερα πλάγια ἐπ' εὐθείας ἐπεξευγμένα, ἵνα φυλάττηται τὸ τῶν πέντε ποδῶν πρὸς ἄλληλα μεταξὺ διάστημα· καὶ τὰ μὲν ὑψηλότερα αὐτῶν ὑπὲρ ἀνδρὸς ἡλικίαν καὶ ἡμισυ,

10 τὰ δὲ ταπεινότερα ὑπὲρ ἀνδρα ἔστωσαν· ἄνωθεν δὲ σκεπόμενα, διὰ τὸ ἄνισον ἐξομοιοῦνται ἀναδενδράσιν, τὸ δὲ ἀπὸ τῆς κορυφῆς τοῦ ἐμβόλου ἄχρι τῶν σκεπομένων ἀνίσων ξύλων ἐν σχήματι ἅμα φανήσεται ἢ χελώνης. Τὰ δὲ ὑπὸ τῶν ὀπλιτῶν βασταζόμενα ξύλα κάτωθεν ὡς ξίφη ἐχέτωσαν, ὅπως τῇ γῆ

15 ἐμπησόμενα τοὺς φέροντας ἀναπαύωσι. Δέρματα δέ, ἢ λῖνα παχέα, ἢ τρύχινα κρεμῶνται ἔξωθεν καὶ κατὰ πρόσωπον· ἐπὶ δὲ τοῖς ἀνίσοις ξύλοις δέρματα ἐπικεῖσθωσαν ἄνωθεν διπλᾶ, οὐκ ἀπεκτεταμένα πρὸς ὁμαλὴν καὶ ἴσην ἐπιφάνειαν, ἀλλ'

f. 7

8: 1–5 γερροχελώνας – ῥάχεως; cf. Philo Mech. 99:29–37. **10:** 1–23 Ὁ – ὑπόκεινται; cf. Apollod. 141:5–143:5.

9: 5 ἀδυνατοῦσαι Mar: ἀδυνατούσας VBP || **10:** 15 ἢ λῖνα Mar: ἠ λινα V: ἡλινα BP: ἡ λινᾶ Wes || 16 τρύχινα VBP: τρίζινα Mar

8. It is better to deploy the so-called wicker tortoises, as they are lighter than the aforementioned beaks and similar in form, constructed from plaiting of freshly cut branches of willow, tamarisk, or lime; these too are sharp in front up to the ridge on top.

9. The so-called *laisai*, being the lightest, are themselves quickly made by plaiting vine stalks or freshly cut <willow> branches in the form of arches; these should not be deployed against steep and precipitous places, lest they bring destruction on those carrying them. For they are too weak to withstand the great bulk of heavy objects; but rather one should use them whenever the cities are situated on even and level terrain; then they will be useful.

10. And the host that is moving upward to an attack on fortifications will follow protected at the widths of the beaks, that is, behind the tortoises, and shielded against archery and slinging by vine tortoises. These are as follows: the hoplites hold upright poles that are alternately unequal in height, about 12 *daktyloi* in circumference, and joined on top on a straight line to other cross<-poles> at 5 *podes*, in order to retain the intervening 5-*pous* distance to one another. The taller of these <poles> are one and a half times a man's height, the shorter ones stand <just> taller than a man. When covered from the top, they resemble vine trellises because of their unequal length. The <part> from the top of the beak as far as the unequal poles, when covered, will appear at the same time in the form of a tortoise. The poles held up by the hoplites should have points at their lower ends, so that when pressed into the ground, they give the carriers a rest. And hides, or thick canvas, or patchwork <coverings> should be hung down on the outside and in front. And double hides should be placed from above on the unequal poles, not stretched taut to an even and equal surface, but drawn together slightly

20 ἐπισυνηγμένα κατὰ μικρὸν καὶ προσκεχαλασμένα πρὸς τοῖς
 ἀνίσοις ξύλοις, ἵνα τῇ τούτων χαννότητι τὰ ἐπιπίπτοντα βέλη
 πρὸς τὴν πληγὴν ἀτονῆ καὶ ἐκλύηται, οἱ δὲ ἰ ἔνδον σκεπόμενοι Wes 209
 ἀβλαβεῖς διαμένωσι. Τὰ δὲ ὑπογεγραμμένα πάντα σὺν τοῖς
 σχήμασι κατὰ τάξιν ὑπόκεινται. ἰ
 11. <E>ἰ δὲ ἐν ἐπιπέδοις καὶ ὀμαλοῖς τόποις ὧσιν αἱ πόλεις
 κείμεναι, τὰς χωστρίδας δεῖ προσάγεσθαι χελώνας, ὑποτρόχους
 αὐτὰς οὐσας καὶ ἔμπροσθεν καταστεγείς, ἵνα οἱ τὰς τάφρους
 χωννύοντες ἀπὸ τῶν ἐναντίων μὴ πλήττωνται· ἢ τὰς
 5 προειρημένας λαίσας, ὡς ἐλαφροτάτας καὶ χρησίμους πρὸς τὸ
 χωννύειν τάφρους, τόπους τε ἐνύδρους καὶ ὑπόμβρους
 ἀναγεμίζειν καὶ παντοῖα λακκίσματα ἐξομαλίζειν τοῖς τείχεσι
 πλησιάζοντα, ὅπως εὐδιάβατον καὶ ἀκίνδυνον τὴν τῶν
 μηχανημάτων ἀγωγὴν ποιησώμεθα. Δεῖ δὲ ἀκριβῶς σκοποῦντας
 10 ἀνερευνᾶν τὰς ἐπὶ τὰς τάφρους φαινομένας ἰσοπέδους
 διαβάσεις διὰ τὰ κάτωθεν πολλακίς κρυπτόμενα ὑπὸ τῶν
 ἐναντίων κεράμια, καὶ τοῖς μὲν ἀνθρώποις εὐδιάβατον καὶ
 ἀκίνδυνον τὴν ὁδὸν ἀποφαίνεσθαι, τοῖς δὲ προσφερομένοις
 15 ὀργάνοις λίαν βαρυτάτοις οὐσι καταδύνειν καὶ διασπᾶσθαι ἐπὶ
 τῇ θραύσει καὶ ἐπιδόσει τῶν ὑποκειμένων κεραμίων. Ὅθεν χρή
 μετὰ ἰ ἀκοντίων εὐτόνων λόγχας ἀσφαλεῖς ἐχόντων ἢ Wes 210
 ὀλοσιδήρων ἢ τρυπάνων τινῶν ἐπιτηδείων τὴν ἀπόπειραν
 ποιεῖσθαι· πρὸς δὲ ἰ τοὺς κατεσπαρμένους ὑπὸ τῶν ἐχθρῶν Wes 211
 σιδηροῦς τριβόλους τῇ γῆ ἰ ἀναμιγνυμένους καὶ ἀφανεῖς ὄντας Wes 212
 20 ξύλινα ὑποθέματα πρὸς τοὺς πόδας τοῖς ὑποδήμασι κάλλτωθεν
 ὑποθέντας ἀβλαβῶς διαβαίνειν ἢ τοῖς γεωργικοῖς κτεσὶν οὐς
 καὶ γριφάνας τινὲς καλοῦσιν, ὀδοντωτοῖς οὐσιν, τούτους
 ἀνακαθαίρειν· καὶ πρὸς τὰς ἐπὶ βοθρεύμασι τιθεμένας θύρας
 25 καὶ τὰς ὑπὸ γῆν πρὸς τῷ τείχει γινομένας ὑπορύξεις κρυφίας
 βαθείας πρὸς τοῖς θεμελίοις ποιεῖσθαι, καὶ μὴ εἰς ὄψιν τῆς γῆς,

11: 2–4 χωστρίδας – πλήττωνται: cf. Philo Mech. 99:41–44. 9–15 Δεῖ – κεραμίων: cf. Philo Mech. 85:23–29. 15–24 Ὅθεν – ἀνασκάπτειν: cf. Philo Mech. 100:4–11. 24–29 Χρῆ – ἀπολέσωσι: cf. Philo Mech. 99:11–13; 18–19.

23 Post ὑπόκεινται vac. reliqua p. V 11: 4 ἀπὸ VBP: ὑπὸ Mar ἰ 15 ἐπιδόσει VBP: ὑφιζήσει Mar ἰ 22 τούτους Mar: τούτοις VBP

and left loose against the unequal poles so that the missiles striking it may be sapped of their force due to the slackness of these <hides> and lose their power, and those covered inside remain unharmed. All the <devices> that have been described are below with the drawings sequentially.

<figs. 1 and 2>

11. If the cities are situated on level and even terrain, one should deploy filler tortoises, which are wheeled and covered in front in order that those filling the ditches not be hit by the enemy; or the aforementioned *laisai*, as these are very light and useful for filling ditches, for filling terrains that are swampy and subject to rain, and for leveling all kinds of depressions near the walls, so as to make the deploying of the machines smooth and without danger. It is necessary to examine with precise reconnaissance those passages over ditches that appear level, since clay pots are often hidden underground by the enemy; and for men the route appears passable and without danger, but under the weight of engines being deployed, since they are quite heavy, it collapses and is torn asunder with the breaking and collapse of the clay pots below the surface. Hence it is necessary to probe with strong lances with secure <iron> points, or all-iron ones, or with appropriate boring tools. And against the iron caltrops sown by the enemy, which are mixed in the earth and invisible, one should put wooden supports under the boots on one's feet to cross unharmed, or clear these away with farm rakes with large tines which some also call *griphanai*. And after first probing for <trap->doors placed over holes, one should dig them up with two-pronged drag-hoes. And one should also make underground tunnels to the foundations of the walls, secret, deep and below the surface of the ground,

ἵνα μὴ διαγόντες οἱ πολέμιοι ἔνδον ἀντορύξωσι καὶ τῷ τείχει ἀντιτροπήσαντες καπνῷ ἢ ὕδατι τοὺς τὴν ὀρυγὴν κατεργαζομένους ἀπολέσωσι.

12. Τὸν δὲ βουλόμενον εὐκόπως πορθεῖν τὰς πόλεις, κατὰ Φίλωνα τὸν Ἀθηναῖον, δεῖ μάλιστα τρυγητοῦ ὄντος ἢ ἑορτῆς ἔξω τῆς πόλεως ἀγομένης ἀθρόαν τὴν ἐπίθεσιν ποιεῖσθαι· πλείστους γὰρ ἔξω τότε χειρούμενον εὐάλωτον ἢ ὑπόφορον καὶ
 5 τὴν πόλιν ἐκ τῶν λοιπῶν οἰκητόρων διὰ τὴν πρὸς αὐτοὺς στοργὴν ἢ συγγένειαν ἀνταλλαπτόμενον ἔξειν. Εἰ δὲ κατὰ κλοπὴν νυκτὸς τὴν πόλιν βουλόμεθα λαβεῖν τῶν πολιτῶν τὴν ἔλευσιν ἡμῶν ἀγνοούντων καὶ ἀνελπίστων ὄντων, χειμῶνος καταλαβόντος ὅτε τῷ κρύει τούτων οἱ πλείους ἐν ταῖς οἰκίαις
 10 συστέλλονται καὶ ἀπαράσκειοι πρὸς μάχην τυγχάνουσιν, ἢ πανδήμου ἑορτῆς ἐν τῇ πόλει τελουμένης καὶ τοῦ Ἰ πλήθους ἢ ἐπὶ τῇ τελετῇ παιγνίοις σχολάζοντος ἢ καταφόρου ὑπὸ τῆς μέθης ὄντος, κλίμακας ποιήσαντες δερματίνας τῷ τείχει προσάξομεν, αἴτινες ῥάπτονται καθάπερ οἱ ἄσκοι καὶ τῇ ἀλοιφῇ
 15 ἐμφραττόμεναι περὶ τὰς ῥαφὰς ἀναγεμίζονται ὥστε μὴ διαπνεῖν· ἐμφυσῶμένων γὰρ καὶ πνεύματος πληρουμένων τοῦ διαπνεῖν κωλυομένων, ἐξορθοῦσθαι αὐτὰς ἀνάγκη, ὑπὸ τοῦ πνεύματος ἀντεχομένων πρὸς τὴν ἀνάβασιν. Εἰ δὲ ὑψηλότερον τῶν κλιμάκων τὸ τεῖχος εἴη, ἐπὶ ταῖς στυπνίαις προὔποτιθενται
 20 κλίμαξιν, αἱ κατασκευάζονται διὰ πλοκῆς καὶ ῥαφῆς δεσμούμεναι, δικτυωταὶ οὔσαι ὡς τὰ λεγόμενα σάρκιναι· εἰς δὲ τὰ ἄκρα αὐτῶν Ἰ ἄγκιστρα προσβάλλονται, ἵνα ἀπὸ τῶν προὔποτεθέντων δερματίνων ἐπιρριπτόμενα ἐπιλαμβάνηται τῶν προμαχώνων καὶ οὕτως τὴν ἐπὶ τὸ τεῖχος ἀνάβασιν τοῖς
 25 βουλομένοις διευθετίξωσι. Τὰ δὲ τῶν κλιμάκων σχήματα ὑπογέγραπται. ἢ

Wes 213
f. 9v

Wes 214

f. 10

13. Ἐὰ δὲ ἀνωτέρω προρρηθέντα ἔμβολα σὺν ταῖς ἀμπελοχελώναις ὅταν ἐγγὺς τοῦ τείχους ἀνέλθωσι, χελώνας δεῖ

12: 1-6 Τὸν - ἔξειν: cf. Philo Mech. 96:27-32. 6-13 Εἰ - ὄντος: cf. Philo Mech. 96:32-34. 13-24 κλίμακας - προμαχώνων: cf. Philo Mech. 102:12-19. **13:** 2-39 ὅταν - ὑπόκειται: cf. Apollod. 143:6-144:11.

27 τὸ τεῖχος Mar ἢ **12:** 6 ἀνταλλαπτόμενον Wes: ἀνταλλαπτόμενον VB ἢ 16 διαπνεῖν Sch: διαπνέειν VB

lest the enemy within spot them and dig a countertunnel and, boring through the wall, kill by smoke or water those working on the tunnel.

12. According to Philo the Athenian, one who wishes to take cities without great labor should attack suddenly, especially at vintage time or when a festival is going on outside a city. For by seizing many people who are outside at the time, he will easily capture the city as well or subject it to tribute, getting this in exchange from its remaining inhabitants out of their affection for or kinship with the <captives>. And if we wish to take the city with stealth by night, <we should act> while the citizens are unaware of our coming and not expecting it, in wintertime when, because of the cold, the majority of them are gathered in their houses and unprepared for battle, or when a public festival is being celebrated inside the city and the majority are playing festival games or are sluggish from drinking. Making ladders of hides we shall bring them to the wall; these are stitched like wineskins and, smeared around the stitches with grease, filled so as not to deflate. For when they are inflated and full of air <and> kept from deflating, they necessarily become upright, held firm for climbing by the air. But if the wall should be higher than the ladders, they are placed beneath ladders of tow which are constructed by being bound together with plaiting and stitching, net-like, similar to the so-called soldiers' packs. Hooks are attached to the ends of these <nets> so that when thrown from the leather ladders placed beneath, they catch on the merlons and thus facilitate the ascent of the wall at will. The drawings of the ladders are delineated.

<fig. 3>

13. And whenever the beaks discussed above go up close to the wall with the vine tortoises, one should then deploy different

τότε διαφόρους προσάγειν, ἄλλας μὲν πρὸς τὸ ὀρύξαι τὸ τεῖχος,
 ἑτέρας δὲ πρὸς τὸ κριοκοπήσαι· ἐπὶ μὲν οὖν τοῦ ὀρύξαι τὰς
 5 λεγομένας ὀρυκτρίδας· ταύτας δὲ ἡ διρρύτους εἶναι καὶ κατὰ
 πρόσωπον σκεπομένας προσάγεσθαι καὶ προσεγγίζειν τῷ τείχει,
 ἢ μονοπτέρους, ὅπισθεν μὲν κατωφερεῖς, κατὰ δὲ πρόσωπον
 τετραγώνους, καὶ ἐκ πλαγίων τραπεζοειδεῖς ὡς τριγώνους,
 κατασκευαζομένας οὕτως· ξύλα λαβόντας τρία ἢ τέσσαρα,
 10 ἔστιν δὲ ὅτε καὶ πέντε διὰ τὸ πυκνότερον καὶ στερεώτερον τοῦ
 ἔργου, μῆκος ἔχοντα μὴ ἔλασσον ποδῶν δέκα, πάχος δὲ ὡσεὶ
 ποδὸς ἐνός, ὁμοίως δὲ καὶ πλάτος, ταῦτα ἀποκόπτειν ἄνωθεν
 λοξῶς ὡς πρὸς ὄνυχα, ἵνα προσφερόμενα δι' ὑποτρόχων
 ἀξόνων, ὑπὸ ὀρθίων ξύλων ἔσωθεν βασταζόμενα, προσεγγίσωσι
 15 τῷ τείχει· ἰστάσθω δὲ πρὸς τῷ τείχει στῦλος ὑπόθεμα κάτωθεν
 ἔχων, ὅστις καὶ τὰ ἐπικείμενα ξύλα καὶ τὰ ὑποστηρίζοντα
 βαστάσει πάρορθα, ἵνα τὰ ἄνωθεν καταφερόμενα μηδὲν
 παραβλάπτοντα τὴν στέγην παρεκπίπτῃ ὅπισθεν. Τὰ δὲ πάρορθα
 ξύλα καὶ πρὸς ὄνυχα ἔμπροσθεν ἐκκεκομμένα κέντρα σιδηρᾶ
 20 ἐχέτωσαν ὅπισθεν, ἵνα ἐμπήσῃσωνται τῇ γῇ καὶ μὴ ἰ
 παρασύρωνται· εἰς δὲ τὰ πλάγια κρεμάσθωσαν δέρματα ἢ ῥάκη
 σκέποντα, ἢ τὰ ἐκ βεργῶν ἢ φοινίκων πεπλεγμένα διὰ τὰ
 ἐκατέρωθεν ἐπιφερόμενα βέλη· ὡσαύτως δὲ καὶ ἐπὶ τὰ
 ἔμπροσθεν. Ὅταν δὲ προσεγγίσωσι τῷ τείχει, ἀναπεταζέσθωσαν
 25 ἐπὶ τὰ ἄνω τὰ ἔμπροσθεν· ὑποκρύπτεσθαι δὲ καθ' ἑκάστην
 χελώνην ἄνδρας δύο ὀρθοὺς ἰσταμένους καὶ σκάπτοντας τὸ
 τεῖχος, πρὸς μὲν πάχος πλέον τοῦ ἡμίσου, κατὰ δὲ πλάτος ὅσον
 καὶ τὸ τῆς χελώνης ἐστί, πρὸς δὲ τὸ ὕψος ἀπὸ τριῶν ποδῶν
 ἄνωθεν τῆς γῆς ἀρχομένους ὀρύσσειν, ἵνα τὰ ἐκ τῆς (ὀρυ)γῆς
 30 καταρχόμενα πρὸς τὸν ἐαθέντα κάτωθεν πίπτωσι τόπον· ἐπὶ δὲ
 τὸ ἀνώτερον μέρος τοσοῦτον σκάπτειν ὅσον οἱ ὀρύσσοντες
 ἀπαρεμποδίστως δυνήσονται. Ἐγγύτερον δὲ εἴκοσι ποδῶν
 διεστηκέτωσαν ἀπ' ἀλλήλων αἱ χελῶναι, ἵνα καὶ πολλοὶ ὦσι
 35 καὶ πολὺν τόπον οἱ ὀρύσσοντες ἐπὶ τὸ τεῖχος ἐργάζωνται· καὶ
 μικραὶ οὖσαι, ἵνα ταχέως καὶ εὐκόπως παράγονται, καὶ ἵνα μὴ
 ἐπ' εὐθείας πρὸς τὸν σκοπὸν φέρηται καὶ εὐστοχῇ πρὸς τὰ
 πλάγια τῶν χελωνῶν τῶν τοσαύτην διάστασιν ἀπ' ἀλλήλων

f. 10v

Wes 215

Wes 216

13: 29 γῆς V: ὄρυ s. s. m. rec. V: ὄρυγῆς B || 32 δυνήσονται Wes: δυνήσονται VB

tortoises, some for excavating the wall, others for ramming. For excavating, therefore, there are the so-called excavating tortoises; these are either saddle roofed and are moved forward and approach the wall covered in front, or are single winged and sloping in back, but quadrangular in front and on the sides trapezoidal, almost triangular. These are constructed thus: taking three or four beams, but sometimes five for thicker and more solid results, with a length of no less than 10 *podes*, a thickness of about 1 *pous*, and a similar width, cut these at the top on a precise diagonal, in order that, carried by wheels on axles <and> held up inside by upright beams, they may approach the wall. A pillar with a counterplate at the bottom should be set up against the wall to hold the beams lying on top with the supports in slanting position, in order that objects coming down from above may slide off behind without harming the roof. And the slanting beams that have been cut precisely in front should have iron spurs on the bottom so that they may fix themselves in the ground and not be dragged out of position. And hides should be hung at the sides, or patchwork coverings or material plaited from <willow> branches or palms, against missiles striking from either side. Let them also be the same in front. When they get close to the wall, the front <coverings> should be furled upward. Two men standing upright and digging through the wall can find shelter under each tortoise; <they should> excavate to a depth greater than one-half <the wall>, to a width as much as that of the tortoise, and in height beginning 3 *podes* above the ground in order that the material coming down from the excavating may fall to the place left below. And the excavators should dig on the upper portion as far as they can without difficulty. The tortoises should stand closer than 20 *podes* apart so that there may be many of them, and the excavators may work at a sizable portion of the wall. <The tortoises> should also be small, so as to be moved sideways quickly and without great labor and so that the missiles thrown by the enemy from the walls may not hit the mark directly and strike the sides of the tortoises, since they have

ἔχουσῶν τὰ ἀπὸ τοῦ τείχους ὑπὸ τῶν ἐναντίων βαλλόμενα. Τὰ δὲ ὑπογεγραμμένα σχήματα ὑπόκειται. ||

f. 11

14. (᾽)Οταν δὲ τρυπηθῆ τὸ τεῖχος ἀπὸ τῆς ὄψεως ἔνδον ἐπὶ τὸ πάχος καὶ διάχωρα κατὰ πλάτος τοσαῦτα λάβη ὅσαι καὶ αἱ χελῶναί εἰσιν, καὶ οἱ ῥηθέντες δύο ἄνδρες ἀπ' ἀλλήλων ἀπεστραμμένοι ἔσωθεν ἀπαρεμποδίστως ἐπὶ τὰ διάχωρα
5 σκάπτωσιν, οὐκέτι χελώνης ἔχουσι χρεῖαν πρὸς τὰ πλάγια μέρη ὀρύσσοντες καὶ ὑπὸ τοῦ πάχους τοῦ τείχους ἔνδον φυλαττόμενοι. Ἴνα δὲ τοῖς σκάπτουσι μὴ συνεμίπτῃ τὸ τεῖχος, ὑποστυλούσθω ἔσωθεν καὶ βασταζέσθω στυλαρίοις λεπτοῖς μᾶλλον καὶ πυκνοῖς, καὶ μὴ παχέσι καὶ ἀραιοῖς, ἐπάνω καὶ
10 ὑποκάτω σανίδος τιθεμένης, ἵνα μὴ πρὸς τῇ γῆ ὑποχαλῶντα τὰ στυλάρια οὐ βαστάσῃ. || Ὅταν δὲ τελειωθῆ τὸ ὄρυγμα καὶ ἐπιστυλωθῆ, (ἀναπληρούσθω) τὸ κατὰ μέσον τῶν ἐπιστύλων ὑλῶν εὐκαύστων, οἷον φρυγάνων, ξύλων ξηρῶν ἐσχισμένων, δάδων καὶ ὅσα τούτων ἕτερα πρὸς ἔκκαυσιν ἐπιτήδεια· καὶ
15 οὕτως ἀναφθήτω. Εἰ δέ τις ἐλλείπει τόπος, πυροβόλοις ὑφαπτέσθω· ἐχέτω δὲ καὶ ξύσματα ξύλων ξηρὰ περιεσπαρμένα σὺν ὑγρᾷ πίσσῃ ἢ ἐλαίῳ ἐπαλιφέντα· καὶ οὕτως ἐκκαέντων τῶν ὑποστυλωμάτων καταπεσεῖται τὸ τεῖχος. Καὶ ἔστιν ἡ ὄψις τοῦ σχήματος τοιαύτη. ||

f. 11v

Wes 217

f. 12

15. (Τ)οῖς δὲ τῶν χελωνῶν τούτων παρορθίοις ξύλοις ἦλοι πλατυκέφαλοι ὕψους δακτύλων ὀκτώ, ἤτοι καρφία ἐκ σιδήρου εἰργασμένα ἄνωθεν ἐμπησέσθωσαν ἄχρι δακτύλων τεσσάρων· τοὺς δὲ λοιποὺς τέσσαρας ὑπερανέχοντας ἐχέτωσαν· τὸν δὲ διὰ
5 μέσου τόπον πηλὸν λιπαρὸν καὶ κολλώδη μετὰ τριχῶν χοιρείων ἢ τραγείων μεμαλαγμένον ἐπιχρίειν καὶ ἀναγεμίζειν, ἵνα μὴ διασπᾶται μηδὲ διασχίζεται. Κρατηθήσεται γὰρ καὶ διὰ τὴν πυκνότητα τῶν ἡλων καὶ διὰ τὸ πλάτος τῶν κεφαλῶν αὐτῶν. Ἐράκη δὲ ἐκ πλαγίων ἢ δέρματα ἐπικρεμάσθωσαν, ἵνα μήτε
10 ἄμμος θερμὴ μήτε | πίσσα μήτε τήλη ἀφεψηθεῖσα μήτε ἔλαιον

Wes 218

14: 1–7 (᾽)Οταν – φυλαττόμενοι: cf. Apollod. 145:1–5. 7–19 Ἴνα – τοιαύτη: cf. Apollod. 145:6–146:3. 15: 1–22 (Τ)οῖς – ὑπόκειται: cf. Apollod. 146:4–147:6.

14: 4 ἀπαρεμποδίστως Wes: ἀπαραποδίστως VB || 10 ὑποχαλῶντα Sch: ὑποχαλῶνται VB || 11 Post στυλάρια add. καὶ Wes || 12 ἀναπληρούσθω add. Wes || μέσον B: μέσου V

such <a small> distance between them. And the drawings described are below.

<fig. 4>

14. Whenever the wall has been perforated from the facade inward toward its depth and receives as many openings along its width as there are tortoises, and the aforementioned two men, back to back inside, dig at the openings without difficulty, they no longer have need of a tortoise, as they are digging toward the sides and are protected inside by the depth of the wall. To keep the wall from collapsing on the diggers, it should be propped up inside and held up preferably by numerous and thin supports, but not by thick and sparsely placed ones. A board should be placed above and below the supports, lest they sink into the ground and not hold <the wall> up. When the excavating is completed and propped up, the area between the props <should be filled> with flammable material such as dry sticks, split dry timbers, pine torches, and other such combustible materials and so be ignited. And if any place fails <to catch fire>, it should be ignited by incendiaries, which contain dry wood shavings covered with liquid pitch or smeared with oil. And so the wall will collapse as the props burn. The view of the drawing is as follows.

<fig. 5>

15. Flat-headed nails 8 *daktyloi* long, that is, small iron spikes, should be driven from above into the slanting beams of these tortoises to a depth of 4 *daktyloi*; and the remaining 4 <*daktyloi*> should rise above the surface. The area between <the nails> should be smeared and filled with greasy and viscous clay, softened with swine or goat hair to keep it from being broken or split. For it will hold fast on account of the denseness of the nails and the width of their heads. Patchwork materials or hides should be hung from the sides to keep hot sand or pitch or boiled fenugreek

ἐπιχεόμενον, ὡς ταχέως φύσει θερμαινόμενον καὶ ψυχόμενον
 βραδέως, τοῖς ἔνδον ἐργαζομένοις ἐνστάζη· παρομοίως γὰρ πυρὶ
 τὰς τῶν ἀνθρώπων ἀναλίσκουσι σάρκας. Οὕτως οὖν
 15 κατεργαζόμεναι αἱ χελῶναι διαφυλαχθήσονται πρὸς τὸ μὴ
 καίεσθαι ἐκ τῶν ἐπιβαλλομένων ἄνωθεν πυροφόρων καὶ
 ἀναπτομένων φλογῶν, μηδὲ διέρχεσθαι ἔνδον τὰ ἐπιχεόμενα
 τεθερμασμένα ὑγρά. Ὡσαύτως δὲ λαῖσαι τε καὶ γερροχελῶναι
 ἐπὶ τὰ πλέγματα σκεπέσθωσαν δέρμασι διαβρόχοις βοῶν
 20 νεοσφαγῶν ὡς δυναμένοις πυρὶ ἀντιμάχεσθαι. Ἢ Αὐταὶ δὲ αἱ
 χελῶναι πόρρωθεν λιθοβόλων ὀργάνων καὶ τοξοβολιστρῶν
 χριέσθωσαν, συμπεπηγῆται δὲ καὶ ὑπότροχοι συμβληθεῖσαι τοῖς
 τείχεσι προσαγέσθωσαν. Καὶ τὸ σχῆμα ὑπόκειται. |

16. (Τ)ινὲς δὲ ἐπὶ λιθίνων τειχῶν ξύλα ὡς ἔθος περιτιθέασι
 προσεγγίζοντα κάτωθεν, ὥστε ἀνάπτεσθαι καὶ θρύπτειν τοὺς
 λίθους. Δύσχηστον δὲ τὸ ἔργον ἐνίστε καὶ ἐπισφαλὲς γίνεται,
 ὅτι καὶ ὕδωρ ἄνωθεν ἐπιχεόμενον σβεννύει τὸ πῦρ, καὶ
 5 ἀσθενεστέρα πρὸς πλάγιον ἢ τοῦ πυρὸς φορὰ γίνεται, ὡς φύσει
 ἀνωφερῆς καὶ πρὸς ἐνέργειαν ἰσχυροτέρα τυγχάνουσα· καὶ οὐ
 δυνήσονται ἐπὶ τῇ τῆς φλογὸς ὀρμῇ οἱ ἔνδον ἐργαζόμενοι ὑπὸ
 χελῶνῃ εἶναι· συγκαήσονται γάρ. Γίνονται οὖν κύθρινοι
 10 ὀστράκινοι διὰ ἢ πετάλων σιδηρῶν ἐπὶ τοῦ ἔξωθεν μέρους
 συνδεδεμένοι καὶ γεμίζονται ἀνθράκων λεπτῶν· ἀπὸ δὲ τῆς
 ἔξωθεν ὄψεως τοῦ πετάλου πρὸς τὸν πυθμένα τέτρηνται
 ἀνεφογότες ἄχρι δακτυλιαίου τρυπήματος καὶ σιδηροῦν
 αὐλίσκον ἐκεῖθεν δεχόμενοι, πρὸς ὃν ἄλλος ἐμβάλλεται
 15 ἄσκωμα ἔχων. Πῦρ δὲ λαβόντες οἱ ἀνθρακες καὶ ἐμφυσώμενοι
 ὁμοίαν φλογὸς ἀπεργάζονται ἔκκαυσιν ὑπεμβαίουσαν τῷ λίθῳ
 καὶ θρύπτουσαν, ἢ ὄξους ἢ οὔρου ἢ τινος ἄλλου τῶν δριμέων
 ἐπιχεομένου. Καὶ ἔστιν τὸ σχῆμα οἶον ὑπογέγραπται. Κέχρηται
 δὲ αὐτῷ συνεχῶς οἱ μολιβδουργοί. ||

17. (Ἐ)ὰν πλίνθινα τεῖχη καταβαλεῖν ταχέως θελήσωμεν,
 πυκνοτάτας ἐπ' αὐτὰ τρήσεις διὰ τρυπάνων ποιήσωμεν, ὑπὸ

16: 1–18 (Τ)ινὲς – μολιβδουργοί: cf. Apollod. 152:7–153:7. **17:** 1–34 (Ἐ)ὰν – τοιοῦτον: cf. Apollod. 148:2–150:3.

16: 8 κύθρινοι Wes: χύθρινοι VB || **17:** 2 ποιήσωμεν Wes: ποιήσωμεν VB

or oil, when poured down, from dripping upon those working within. For these substances naturally heat up quickly and cool slowly <and> destroy men's flesh like fire. Tortoises so prepared will then be protected against burning by incendiaries launched from above and by ignited flames, nor can the hot liquids that are poured upon them penetrate inside. Similarly *laisai* and wicker tortoises should be covered on the plaited parts by wet hides of freshly slaughtered cattle as these are able to withstand fire. These tortoises should be coated far away from stone-throwing engines and arrow shooters, and brought forward to the walls <already> assembled and supplied with wheels. And the drawing is below.

<fig. 6>

16. In the case of stone walls, some customarily put wood beams near the bottom, so that they can be ignited and shatter the stones. This operation is at times difficult and precarious, both because water poured from above quenches the fire and because the impetus of fire is weaker to the side, as by nature it rises up and is stronger in its effect <in that direction>. Those working within will not be able to remain under the tortoise because of the force of the flame; for they will be burned. Therefore, earthenware pottery is secured on the outside with iron plates and filled with powdered charcoal. <The pots> are perforated from the outer facade of the plate toward the bottom <and> opened with a hole up to 1 *daktylos* <in diameter> and receive a small iron tube therein. Into <this tube> another <tube> is inserted which has a bellows. When the charcoal is ignited and fanned, it creates a combustion like an <open> flame that goes in under the stone and breaks it, when vinegar or urine or some other acidic <liquid> is poured upon it. And the drawing is such as has been described. Lead workers also regularly employ this <device>.

<fig. 7>

17. If we wish to bring down brick walls quickly, we shall make numerous perforations in them with borers while <we are>

χελωνῶν ἄνωθεν ἐπικεχρισμένων σκεπόμενοι, ἢ λαισῶν
 ἀσφαλεστάτας στέγας ἔχουσῶν καὶ δέρμασι βοῶν νεοσφαγῶν
 5 περὶ τὰ πλέγματα σκεπομένων διὰ τε τὰ πεμπόμενα κατ' αὐτῶν
 βάρη καὶ τὰ ἐγγεόμενα τεθερμασμένα ὑγρά. Τὰ δὲ τρύπανα
 ἔστωσαν τεκτονικοῖς ὄργανοις παρόμοια· μοχλὸς γὰρ γίνεται
 σιδηροῦς μήκους ποδῶν μὴ ἔλασσον πέντε, δακτυλαιάν τὴν
 διάμετρον ἔχων καὶ πάχος γυρόθεν ὡσεὶ δακτύλων τεσσάρων,
 10 πέταλον ὁμοίως σιδηροῦν ἐπὶ τὸ ἔμπροσθεν ἄκρον
 προσηλωμένον ἔχων πλάτους δακτύλων δώδεκα καὶ ὕψους
 ὀκτώ, ἐστενωμένον κατὰ μέσον ἔμπροσθεν ἐν σχήματι
 κηπουρικοῦ πλατυλισγίου· πρὸς δὲ τὸ ἕτερον ἄκρον ξύλινον
 15 ἀπὸ τόννου μεσόστενον εἰσδέχεται κύλινδρον ὑπὸ ἀρίδος
 στρεφόμενον, ἔχοντα κατὰ μέσον τοῦ ὀπισθίου μέρους
 κεφαλοειδῆ παρεξοχὴν ὑπεμβαίνουσαν καὶ ἀναστρεφομένην
 ἐπὶ τὴν ὀνομαζομένην πυελίδα ἣτοι ἐπικεφαλίδα τινὰ οὖσαν,
 κανόνος τῇ γῆ ἐπικειμένου τοῦ προσιάγοντος αὐτὴν καὶ
 20 ἐπακολουθοῦντος αἰὲ τῷ τρυπωμένῳ τόπῳ. Περιστραφίσεται ἢ
 δὲ πρὸς τὴν αὐτὴν ἐργασίαν καὶ διὰ χειρῶν κινούμενος ὁ
 κύλινδρος σὺν τῷ τρυπάνῳ, εἰς κανόνια πρὸς τὸ μέσον
 εἰσδέξεται ὡς φρεατίας ἡλακάτης σταυροειδῶς διεκβληθέντα,
 ἅ τινες ἐκ τοῦ σχήματος ἀστερίσκους καλοῦσιν. Τὰς δὲ
 25 γινομένας ἐπὶ τῷ τείχει τρυπήσεις πλαγίας τε καὶ ἀνωφερεῖς
 ποιῆσθαι ὡς πρὸς τὸ ἐνδότερον μέρος ὑψηλοτέρας, ὅπως τὰ ἐκ
 τῆς πλίνθου ὑπὸ τῶν τρυπάνων περιζεόμενα εὐκατάφορα
 γίνηται καὶ τὸ ἐπ' ἄκρον τοῦ μοχλοῦ προσηλωθὲν πέταλον
 30 καλῶς πρὸς τὴν ἐργασίαν ἀναβαστάζεται στηριζόμενον ὑπὸ
 τοῦ τῇ γῆ πλαγίου ἐπικειμένου κανόνος καὶ πρὸς αὐτῇ
 ἀντιστηριζομένου. Ἡ δὲ ἐκ τῶν τρυπάνων γινομένη ἀνωφερὴς
 σύντησις οὐ ποιεῖ συγκάθεσιν μόνην τοῦ τείχους, ἀλλὰ καὶ
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 παρεγκεκλιμένην ἐπὶ τὴν ἔξω καταφορὰν. Καὶ γίνεται ἀθρόως
 πολὺ περὶ τὸ τείχος τὸ σύμπωμα. Καὶ ἔστιν τὸ τῆς κλίσεως
 σχῆμα τοιοῦτον. ἢ
 14v

18. <Τ>ρυπάσθω δὲ ἐξ ἴσου τὸ τείχος ἐπὶ τῆς αὐτῆς εὐθείας,

18: 1–2 <Τ>ρυπάσθω – τέταρτον: cf. Apollod. 150:4–5.

24 Post ἀνωφερεῖς add. δεῖ Wes ἢ 31 συγκάθεσιν Wes: συγκάθησιν VB

Parangelmata Poliorcetica

covered by tortoisés coated on top or by *laisai* that have very secure roofs and are covered on the plaited parts with hides of freshly slaughtered cattle to ward off the heavy objects sent against them and the hot liquids poured on them. The borers should be similar to a carpenter's tools: for this is an iron bar no less than 5 *podes* in length with a diameter of 1 *daktylos* and a circumference of about 4 *daktyloi*. It has a blade that is also iron affixed to the front end, 12 *daktyloi* wide and 8 long, narrowed in the center in front like a garden spade. At the other end it receives a wooden cylinder <made> on a lathe, narrow in the middle <and> turned by a bow. It has at the center of the rear section a head-shaped projection that goes in under and turns in what is termed a socket, that is, a type of cap. A rod resting on the ground applies and directs it continuously at the place being bored. The cylinder with the borer will be whirled around with the same effect even when moved by hand, if it should receive small rods in its mid-section, inserted in the form of a cross like a well windlass, which some from the shape call little stars. Make the holes in the wall at an upward angle, higher toward the interior, so that the material routed from the brick by the borers may easily fall down; and so that the blade affixed to the end of the bar may be properly raised up to its task, supported by the rod that rests on the ground at an angle and supports itself thereon. The joint-channel of the bore holes made by the borers, since it slants upward, will not only cause the wall to sink, but to fall outward, with a sudden, quite massive collapse of the wall. And the drawing of the inclination is as follows.

<figs. 8 and 9>

18. The wall should be bored evenly along the same straight

ἀπεχομένων ἀπ' ἀλλήλων τῶν τρυπημάτων πόδα καὶ τέταρτον, τουτέστι δακτύλους εἴκοσι, ἤτοι σπιθαμὴν καὶ δύο παλαιστάς· ἔστι γὰρ ἡ σπιθαμὴ δακτύλων δώδεκα, ἡ δὲ παλαιστὴ τεσσάρων.

5 Τὰς δὲ τρυπήσεις ἀπὸ τῆς γῆς ἄνωθεν ἀπαρχομένους ἢ ποιείσθαι ὡς ἀπὸ ποδῶν τριῶν, καθάπερ καὶ ἐπὶ τῶν λιθίνων προειρήκαμεν τειχῶν, ἵνα ἢ ἐκ τῶν τρημάτων κατερχομένη ὕλη ἐπὶ τὸν ἐαθέντα κάτωθεν πίπτῃ τόπον. f. 15

19. Ὅταν δὲ τρυπηθῆ κατὰ τάξιν τὰ μέτωπα τοῦ τείχους, ἀναγεμίζονται τὰ τρήματα ἐκ τῆς ἔξωθεν ὄψεως ἐπὶ τὰ ἔνδον, οὐ πρὸς ὅλον τὸ πάχος ἀλλ' ἐπὶ πόδα μόνον, ξύλοις ξηροῖς ἐσχισμένοις, μὴ τετραγώνοις ὥστε κατὰ πλάτος ἐφαρμόζειν

5 ἀλλήλοις, ἀλλὰ παραστρογγύλοις ὡς πασσάλοις, πάχος ἔχουσι πρὸς τὴν βάσιν δακτύλων μὴ πλέον τριῶν, πρὸς δὲ τῇ κορυφῇ μᾶλλον ἐστενωμένοις πρὸς τὸ βαστάζειν τὸ τεῖχος κατὰ τὸν τῆς ἐργασίας καιρὸν. Καί, εἰ ἐνδέχεται, δῆδες οἱ πάσσαλοι ἔστωσαν· εἰ δὲ μή, ξύλα ξηρὰ πεπισσωμένα ἢ θείῳ τετριμμένῳ
10 σὺν ὑγρῷ πίσσῃ ἢ ἐλαίῳ ἐπαλιφέντα· στρογγύλοι δὲ γίνονται οἱ πάσσαλοι, ἵνα μεταξὺ πρὸς ἀλλήλους διαλείμματα ἔχωσιν, ἔνθα τὸ πῦρ ὑπεμβαῖνον καὶ ἀναστρεφόμενον ἐπανάπτῃται, καὶ μὴ τῇ πυκνότητι συμπιγόμενον σβεννύηται. Ὅταν δὲ γεμισθῶσι πάντα τὰ τρήματα ποδὸς ἄχρι κατὰ βάθος, ὡς
15 εἴρηται, πάλιν ἐπὶ τῆς αὐτῆς εὐθείας τρυπάσθωσαν κατὰ μέσον τὰ καταλειφθέντα διάχωρα κατὰ τάξιν ἐξ ἴσου πρὸς τὰ πρότερα. Τὰ δὲ ἔσχατα ἢ τρήματα πλαγιαζέσθωσαν ἐφ' ἑκάτερον μέρος, f. 15v

ἵνα ἐπὶ τὰ πρότερα ἢ τῶν ὑστέρων ἐπεισέρχῃται σύντησις, καὶ γεμισθῆτωσαν καὶ αὐτὰ ξυσμάτων ἢτοι πελεκημάτων ἢ
20 ῥυκανισμάτων ξηρῶν καὶ εὐκαύστων φρυγάνων ἢ σχιδάκων, καθ' ὧν τὸ πῦρ ἐπιδρασσόμενον ταχεῖαν τὴν ἔκκαυσιν ποιεῖται. Ἐξεπίτηδες οὖν οἱ πάσσαλοι οὐκ ἔχουσιν ἴσῃν τὴν ἐπιφάνειαν κατὰ τὸ ὅλον ὕψος, ἀλλὰ μείζονές εἰσι κάτωθεν, ὥστε κρατεῖν δύνασθαι τὸ πῦρ καὶ ἀνέμου ἐμπνέοντος ἐπανάπτῃται. Εἰ δὲ
25 νηνεμία κατὰ τὸν τῆς ἐργασίας καιρὸν ἢ τόπον εἶη,

5–8 Τὰς – τόπον: cf. Apollod. 144:6–7. **19:** 1–29 Ὅταν – ἔχοντες: cf. Apollod. 150:6–152:4.

18: 5 Post ἀπαρχομένους add. δεῖ Wes

line, with the borings $1\frac{1}{4}$ *podes* apart, that is, 20 *daktyloi*, that is, 1 *spithame* and 2 *palaistai*; for the *spithame* is 12 *daktyloi*, the *palaiste* 4. Make the holes starting about 3 *podes* up from the ground, as we also mentioned earlier for stone walls, so that the material coming down from the apertures may fall into the space left below.

19. When the face of the wall has been bored in sequence, the apertures are filled from the facade inward, not to their complete depth, but only to 1 *pous*, with <pieces of> split dry timbers, which are not squared so as to fit <tightly> against one another on their sides, but rounded like stakes, with a thickness at the base of no more than 3 *daktyloi*, but narrower toward the top, to hold the wall up during the course of the work. And, if possible, the stakes should be pine torches; otherwise they should be dry wood covered with pitch or smeared with pulverized sulphur <mixed> with liquid pitch or with oil. The stakes are rounded so as to have spaces between one another, where fire going in under and coming back may ignite and not be extinguished, choked off by obstruction. Whenever all the apertures have been filled up to a depth of 1 *pous*, as mentioned, the remaining areas between them should be bored in sequence evenly with the earlier ones, again on the same straight line. And these last apertures should be made diagonally in both directions, in order that the channels of these latter ones may join with the earlier ones; and these too should be filled with <combustible> particles, that is, chips or dry shavings and combustible dry sticks or split wood through which the fire catches <and> creates rapid combustion. Intentionally, therefore, the stakes do not have an equal surface over their entire length, but are thicker at the bottom, so that the fire is able to catch and ignite when the wind blows. And if there should be no wind at the time or place of the work, reeds should be joined

συμβαλλέσθωισαν κάλαμοι τετρυπημένοι δι' ὄλου ἔσωθεν, οἴους οἱ ἰξευταὶ ἔχουσιν, ἀσκώμασι χαλκικοῖς ἐμφυσώμενοι· πρὸς ὃν γὰρ ἂν τις ἐθέλῃ μεταφέρονται τόπον καὶ ἀνάπτουσι τὸ πῦρ, σιδηροῦν ἀύλισκον ἔμπροσθεν τοῦ πυρὸς ἔχοντες. Καὶ τὸ σχῆμα ὑπόκειται. ||

Wes 224

f. 16

20. (Τ)ῆς συντρήσεως ἐπὶ τῇ ὑποστυλώσει καὶ ἐκκαύσει τελεσθείσης καὶ τοῦ τείχους ἀκλινῶς ἠδρασμένου καὶ ἀτρεμοῦντος ἐπὶ τῷ συμπάχῳ τῆς πλινθίνης οἰκοδομῆς τεχνουργήματι, κριομαχεῖν ἀνάγκη. Εἰ γὰρ καὶ ἔκλυτος καὶ ἀνίσχυρος ἢ τοῦ κριοῦ πρὸς τὴν πλίνθον γίνεται πληγῇ, λακκίζουσα μᾶλλον διὰ τὸ χαῦνον καὶ μαλακὸν ἢ σειούσα καὶ ῥηγνύουσα διὰ τὸ σκληρὸν καὶ ἀντίτυπον ὡς ἐπὶ λίθων, ἀλλ' οὖν διὰ τῆς προγεγονῆσας κάτωθεν ἐργασίας ἀτονῆσαν πρὸς τῇ βάσει τὸ τεῖχος οὐ δυνησεται ἀντέχειν πρὸς τὰς συνεχεῖς τῶν κριῶν κερατίσεις, ἀλλὰ τῇ βίᾳ πληττόμενον πρὸς τῇ συντρήσει τὴν κλίσιν εἰσδέξεται. |

Wes 225

21. Τὰς δὲ συμβολὰς καὶ συνδέσεις τῶν κατὰ μῆκος συμβεβλημένων κριῶν, τὰς τε περὶ τὰ κῶλα αὐτῶν καὶ τὰς ἐπὶ τῶν μονοξύλων κατὰ διάστασιν ἀνηκούσας ἀρτήσεις ἐπὶ τε κριοφόρων χελωνῶν πύργων τε καὶ τῶν διπλῶν κλιμάκων, καὶ ἔτι τὰς δι' αὐτῶν πρὸς τὸ τεῖχος γινομένας εὐεργεῖς διαβάθρας, πρὸς τὴν ἀρμόζουσας ἐφεξῆς ἐκάστῳ ἐργασίαν ἐπὶ τῆς προκειμένης πραγματείας λεπτομερῶς διασαφήσαντες ἐξεθέμεθα. ||

f. 16v

22. (Ε)ὰν τάχιον μετὰ κριῶν θελήσωμεν τείχη ἢ πόρτας ῥηγνύειν καὶ διασπᾶν, κριοφόρους ποιήσομεν χελώνας τετρατρόχους ὑψηλάς, ἄνωθεν ἀλύσεις ἢ σχοινία εὐτονα κατὰ πάχος ἐχούσας τὰ τὸν κριὸν βαστάζοντα καὶ ἀνέχοντα· ἀφ' ὑψηλοῦ γὰρ βασταζόμενος ὁ κριὸς πλέον ὀπισθεν διάστημα πρὸς τὴν κίνησιν λαμβάνει, καὶ ἐκ μακροῦ ἐπιφερόμενος καὶ ἐνσειόμενος πλέον ἐνδυναμοῦται καὶ προσκρούων τῷ τείχει βιαίαν καὶ ἰσχυρὰν ἀποτελεῖ τὴν πληγὴν. Ἔστω δὲ τῷ εἶδει ὑψηλῇ ἢ χελώνῃ καὶ μὴ τοσοῦτον μεγάλη, ἵνα πρὸς τὴν κίνησιν εὐπαράγωγος ᾖ, διπλάσιον τὸ ὕψος τοῦ πλάτους ἔχουσα, τὸ δὲ

22: 1–65 (Ε)ὰν – ὑπόκειται: cf. Apollod. 153:8–156:2.

together, totally hollowed out inside, such as fowlers have; they are blown into by a bronzesmith's bellows. These are brought to any place one wishes and kindle the fire, having an iron pipe in front where the fire is. The drawing is below.

<fig. 10>

20. When the interconnected perforation as well as the propping and combustion have been completed, if the wall should <still> stand steadfastly and be unshakable because of the thick fabrication of the brick construction, it is necessary to attack with rams. For even if the blow of the ram against the brick is dissipated and weak, and it makes pit holes because of the porousness and softness <of the brick> — rather than shaking and shattering as occurs with stones that are hard and offer resistance — yet due to the earlier work at the bottom, the wall, weakened at its base, will be unable to withstand the continuous batterings of the rams, but struck by force it will begin to incline because of the interconnected perforation.

21. As for the couplings and bindings of the rams that are joined lengthwise, the suspension systems that are appropriate in spacing for both the sections of the <composite> rams and single-beam ones (those on ram-bearing tortoises, on <portable> towers, and on double ladders), and further the drop-bridges that are effective against the wall through them — having clarified these minutely we have set them forth in the present treatise according to the operation successively fitting for each.

22. If we wish to use rams to shatter and break through walls and gates more quickly, we shall make ram-bearing tortoises, four-wheeled tall ones, which have chains or strong, thick ropes <suspended> from above to lift and hold up the ram. For if lifted up from a height, the ram obtains more space behind for movement, and carried and launched over a long distance, it gathers more momentum and, striking the wall, renders a forceful and strong blow. The tortoise should be tall in form and not <otherwise> very large, so that it may be easily positioned for movement, having a height twice its width, the length equal to

- μῆκος τοῦ ὕψους ἴσον ἢ μικρῶ ἔλασσον, ἵνα ὀξύρρυτος καὶ ἐπιμήκης εἶη, ὡς ἂν τὰ ἐν αὐτῇ ἐπιπίπτοντα βάρη πλαγιαζόμενα παρεκτρέχη κάτωθεν. Κατασκευάζεται δὲ οὕτως. Ζυγὰ δύο καὶ
- 15 δύο τίθενται μήκους ὄντα ἀνὰ ποδῶν κδ', διεστῶτα ἀπ' ἀλλήλων | ποδῶν οὐκ ἔλασσον δώδεκα· καὶ πρὸς αὐτὰ Wes 226
- ἐμβάλλονται ξύλα δακτύλων κατὰ πάχος δώδεκα, πλάτους ποδὸς οὐκ ἔλαττον, εἴκοσι τεσσάρων ποδῶν πρὸς ὕψος, ἀριθμῶ ὄντα ὀκτώ, τέσσαρα καὶ τέσσαρα ἀφ' ἑκατέρων τῶν πλαγίων μερῶν ἐφιστάμενα· συννεύοντα δὲ ἄνωθεν κατὰ κορυφὴν
- 20 συμβάλλει ἀλλήλοις, περιλαμβάνοντα || ξύλον, ὃ ἐστὶ ράχιν τῆς χελώνης, μακρότερον τοῦ περὶ τὰ ζυγὰ μήκους, καὶ παρεξέχον ἔμπροσθεν δι' ἄς προϊόντες λέξομεν αἰτίας, καθ' ὃ δὲ μέρος τὴν χελώνην προσνεύειν βουλόμεθα· κατὰ μέσους τοὺς ὀρθοστάτας τούτοις ἄλλα ζυγὰ προσηλούσθω, καὶ ἐκ τοῦ
- 25 ἔσθωθεν μέρους ὑποβεβλήσθωσαν παραστάται ἀντέχοντες καὶ στηρίζοντες τὰ μέσα ζυγὰ καὶ τὴν ράχιν· τῇ δ' ἔξωθεν ἐπιφανείᾳ σανίσι κατὰ πάχος τετραδακτύλοις οἱ ὀρθοστάται σκεπέσθωσαν. Καὶ οὕτως συντελεῖται τὸ σχῆμα. Ἐκ δὲ τοῦ ἐδάφους τῶν ἔσω ζυγῶν ὑποστυλούσθω τὰ ἔσω ξύλοις ὀρθοῖς,
- 30 ἀκλινέσι κατὰ κάθετον οὔσι· τὸ δὲ μεταξὺ κένωμα τὸ περὶ τὰ κάτω ζυγὰ, τουτέστι τὸ διάστημα, τροχοὺς τέσσαρας ἐχέτω τοὺς ἀνέχοντας καὶ βαστάζοντας τὸ ὅλον περὶ τὴν χελώνην σύμπηγμα. Ἴνα δὲ μὴ ἀνοίγηται τὰ κάτω ζυγὰ, περιτομίδας προσλάβοι οὐκ ἔξω τομῆς | γινομένης, ἀλλὰ χελωνίων Wes 227
- 35 προσηλώσει κρατούσας, ὡσανεὶ γρονθαρίων τινῶν περικεκομμένων καὶ ἡμισφαιρίων ἐγγεγλυμμένων, παρομοίων τοῖς ἐπὶ τῶν στροφίγγων τῶν θυρῶν τιθεμένοις, αἱ βάσεις ἔσονταί τῆς ὀξύρρυτου χελώνης. Γίνεται δὲ ὅτε ἀμβλυτέρα καὶ ταπεινότερα ἢ τῆς χελώνης στέγη, ὅταν ἐπὶ (τῶν) μεσοστατῶν
- 40 τῶν ἐπὶ τὰ ζυγὰ ὀρθίων ἐστώτων ἄνωθεν προστεθῶσιν οἱ λεγόμενοι || συγκύπται καὶ τὴν ἀνωτάτην τοῦ ἀετώματος f. 17v περιλάβωσι ράχιν, μακροτάτου δηλονότι τοῦ κριοῦ ὄντος καὶ

22: 22 λέξομεν B: λέξομεν V || 23 βουλόμεθα B: βουλώμεθα V || 24 τούτοις Wes: τούτους V: τούτου B || 29 ἔσω² VB: ξ s.s. m. rec. VB: ἔξω Wes || 33 περιτομίδας Sch || 34 γινομένης Sch: γινομένης VB || 38 ὅτε Sch: ὅτε VB || 39 τῶν add. Sch || 42 μακροτάτου m. rec. V, B: μικροτάτου V

or slightly less than the height; thus it will be steep-roofed and oblong, so that heavy objects striking it may be deflected <and> fall sideways to the ground. It is constructed thus. Beams of about 24 *podes* in length are placed two by two, no less than 12 *podes* apart; and upon them are placed timbers about 12 *daktyloi* thick, not less than 1 *pous* wide, 24 *podes* high, eight in number, standing four by four on both sides. Leaning above toward one another they meet at the peak, encompassing a timber that is the ridge-pole of the tortoise. This <ridge-pole> is longer than the length of the <base->beams and projects forward — for reasons we shall discuss as we proceed — at that part where we wish the tortoise <roof> to slope forward. At the middle of the uprights other <horizontal> beams should be nailed to these, and on the inside supports should be placed beneath to hold and prop up these middle beams and the ridge-pole. On the outside surface the uprights should be covered with boards 4 *daktyloi* thick. Thus the frame is completed. From the bottom of the interior beams let the inner ones be supported by uprights that are perpendicular <and> straight. The empty space between the lower beams, that is, the interval, should have four wheels that hold up and lift the entire superstructure of the tortoise. In order that the lower beams not come apart, they should receive angle braces with the cut edge unexposed, but these get their strength by having shell-caps affixed to them, like some cutout little fists and hollowed-out hemispheres, similar to those placed on door pivots. These will be the bases of the steep-roofed tortoise. Sometimes the roof of the tortoise is blunter and flatter, whenever the so-called rafters rest up top upon the midsupports that stand upright on the beams, and encompass the uppermost ridge-pole of the gable; <this is possible> when the ram is obviously quite long and the

τῆς χελώνης πόρρω τοῦ τείχους ἀφεστώσης. Εἰ γὰρ ἐλάσσωσιν ὁ
 κριὸς κατὰ μῆκος τύχη καὶ ἡ χελώνη τοῦ τείχους ἔγγιον εἶη, οὐ
 45 δυνήσεται ἀντέχειν πρὸς τὰ ἐπικρημιζόμενα καὶ πρὸς αὐτὴν
 ἐπιπίπτοντα βάρη διὰ τὸ τῆς στέγης ταπεινῶμα, ἀλλὰ ῥῆξιν ἢ
 θραυδὸν ἐπὶ ταῖς τῶν ἀρμονιῶν λαβοῦσα συμβολαῖς ἐπισηφελῆς
 ἑαυτῇ τε καὶ τοῖς κριομαχοῦσι γενήσεται. Τὴν δὲ ὑπὸ τῶν
 προειρημένων παρορθίων μονοξύλων ἐπιλαμβανομένην ἄνωθεν
 50 ῥάχιν χρῆ παρέξειν ἔμπροσθεν κατὰ πρόσωπον τοῦ τείχους, ἵνα
 ἐπ’ αὐτὴν προστέγασμα ἦ καὶ τὰ ἐπὶ τῷ κριῷ πεμπόμενα
 προσδέχεται· εἰ γὰρ οἱ ἀπὸ τοῦ τείχους καταφερόμενοι μέγιστοι
 λίθοι καὶ τὰ πλάγια ξύλα τὰ ἐξ ἴσου ἰσοβαρῶς καὶ ἰσοζύγως
 κατερχόμενα ἀστέγαστον τύχωσι τὸν κριὸν τῷ τείχει
 55 ἐπιφερόμενον, εἴτε αὐτὸς ὁ κριὸς περινεύσας διασπασθήσεται,
 ἢ τοὺς κινούντας ἀπορρίψει καὶ διαφθερεῖ. Τοιαύτη μὲν ἐστὶν
 ἡ ἔμπροσθεν χελώνη | ἢ καὶ τὰς βασταγὰς τοῦ κριοῦ κατὰ Wes 228
 διάστασιν ἔχουσα. Ἡ δὲ δευτέρα ταπεινότερα πρὸς ὕψος καὶ
 ἐλάσσωσιν· καὶ ἄλλαι δύο κατόπισθεν ἔτι ἐλάσσονες· πρὸς
 60 ἀσφάλειαν γὰρ παρόδου ἀναγκαῖαι τυγχάνουσι. Πλείονας δὲ
 αὐτὰς εἶναι καὶ μικράς, ὡς προείπομεν, διὰ τὸ εὐκόπως
 προσάγεσθαι καὶ ἐκ μικρῶν συμπήγνυσθαι ξύλων, καὶ μὴ μίαν
 μεγίστην διὰ τὸ ἐκ μεγάλων καὶ δυλλσευρέτων γίνεσθαι καὶ διὰ f. 18
 τὸ βραδέως καὶ δυσκόπως παράγεσθαι. Τὰ δὲ σχήματα κατὰ
 65 τάξιν ὑπόκειται.

23. Καὶ δεῖ εἰδέναι ὅτι ὑπὸ τῆς ἔμπροσθεν καὶ μείζονος
 χελώνης βασταζόμενος ὁ κριὸς ἐπὶ πλεον ὑψοῦται κατὰ
 πρόσωπον τοῦ τείχους, ἐπὶ δὲ τῶν ὀπισθεν ταπεινοῦται· καὶ γὰρ
 ἀνωφερῶς κινούμενος σφοδροτάτην ἐπὶ τὰ ἀνώτερα τῶν τειχῶν
 5 ἀποτελεῖ τὴν πληγὴν· ἐπὶ δὲ τὰ κάτω συγκύπτων ἀσθενεστάτην
 καὶ ἔκλυτον, ἐνίοτε δὲ καὶ ἐπισηφελῆ. || | f. 18v

24. (Ἐ)ν ἀπάσαις δὲ ταῖς χελώναις ἦλοι πλατυκέφαλοι, ὡς Wes 229
 προείρηται, ἄνωθεν ἐμπησέσθωσαν πρὸς τὰ τῆς στέγης πλάγια
 καὶ κατωφερῆ μέρη ἄχρι τοῦ ἡμίσεος αὐτῶν, καὶ τὸ διὰ μέσου
 ἀνεστηκὸς ἀναπληροῦσθω πηλοῦ λιπαροῦ καὶ κολλώδους μετὰ

24: 1–22 (Ἐ)ν – ὄν: cf. Apollod. 156:3–158:1.

50 παρεξέχειν Sch || 54 τύχωσι VB: τύπτωσι Sch || 60 Post δὲ add. δεῖ Wes

tortoise far from the wall. For if the ram is shorter in length and the tortoise is nearer the wall, it will not be able to withstand the heavy objects hurled down and striking it, on account of the flatness of the roof, but will be broken or destroyed at the joint-fittings and become dangerous to itself and those attacking with the ram. The ridge-pole above, which is held by the previously mentioned slanting one-piece timbers, must project forward to the face of the wall, in order to have a front covering on it and <thus> intercept objects sent against the ram. For if the very large stones thrown from the wall and the beams that are descending evenly parallel <to the wall>, equally weighted and balanced, should encounter the uncovered ram as it attacks the wall, either the ram itself will sway and be destroyed or it will throw and kill the men moving it. Such is the front tortoise that holds the suspended sections of the ram at intervals. The second tortoise is lower in height and smaller. And behind them are two others smaller still, which are necessary for a secure approach. These tortoises must be numerous and small, as we said earlier, so they can be moved forward without great labor and assembled from small beams, rather than one very big <tortoise>, because this would require large and difficult to find materials and be moved into position slowly and with difficulty. The drawings are below in sequence.

<fig. 11>

23. You should be aware that the ram, lifted up by the forward and larger tortoise, is higher at the face of the wall, lower toward the rear. For if directed upward it delivers a very forceful blow against the upper parts of the wall; but if it strikes against the lower parts, <it delivers> a very weak blow, dissipated and sometimes even destabilizing.

24. In all the tortoises flat-headed nails, as mentioned previously, should be driven from above to half their <length> into the sloping and descending parts of the roof. And the raised area in between should be filled with greasy and viscous clay soft-

5 τριχῶν μεμαλαγμένου καὶ ἀδιασχίστου συντηρουμένου. Πρὸς
 δὲ τοὺς τροχοὺς τοὺς βαστάζοντας τὴν χελώνην ἐπὶ τὰ κάτω
 ζυγὰ σφήνας εὐμεγέθεις ὑποθεῖναι ἀφ' ἑκατέρων τῶν μερῶν
 ὑπεμβαίνοντας, ὥστε ἀντέχειν πρὸς τὸ τοῦ ὕψους μέγεθος· αἱ
 γὰρ τῶν τροχῶν περόναι μόναι καὶ μάλιστα αἱ περὶ ἕκαστα τὰ
 10 ζυγὰ διερχόμεναι δίκην ἀξόνων, βραχεῖαι οὖσαι, οὐ
 δυνήσονται βαστάσαι τὴν χελώνην, οὐδὲ ἀσφαλῶς αὐτὴν
 ἵσταμένην ἔξομεν πρὸς τὴν μέλλουσαν γίνεσθαι τοῦ κριοῦ
 ἐπικίνησιν. Ὑποβάλλονται δὲ κάτωθεν οἱ σφήνες, οὐ μόνον τὸ
 τοῦ ὕψους ἀντεχόμενοι βάρος, ἀλλὰ καὶ τὴν τῶν τροχῶν
 15 κωλύοντες παρακίνησιν· ὅταν δὲ θελήσωμεν ἐπικινήσαι τὴν
 χελώνην, τοὺς κάτω τεθέντας ὑποχαυνώσωμεν σφήνας. Καὶ δεῖ
 εἰδέναι ὅτι τὰ λίθινα τεῖχη τάχιον ἐνσειέται καὶ ῥήγνυται τῶν
 πλινθίων· διὰ γὰρ τὸ χαῦνον καὶ μαλακὸν τῆς πλίνθου ἢ ἐκ
 τοῦ κριοῦ γινομένη πληγὴ ἀσθενής ἐστὶ καὶ ἔκλυτος, βαθύνουσα
 20 τὴν πλίνθον καὶ λακκίζουσα (μᾶλλον) ἢ ῥηγνύουσα καὶ
 διασπῶσα· ὁ δὲ λίθος πρὸς τὴν τοῦ σιδήρου σκληρότητα
 ἀντίτυπος ὢν (. . .) || I

f. 19

Wes 230

25. (Ο)ὶ δὲ περὶ Ἠγήτορα τὸν Βυζάντιον τὸν μέγιστον κριὸν
 πηχῶν ἑκατὸν εἴκοσι κατὰ μῆκος ἐποίουν, ἐκ δὲ πτέρνης κατὰ
 μὲν πάχος ποδιαῖον, εἰς δὲ πλάτος παλαιστῶν πέντε· ἐπὶ δὲ τὸ
 ἔμπροσθεν ἄκρον συνήγον αὐτὸν εἰς πλάτος ποδιαῖον καὶ πάχος
 5 τριπάλαιστον· ἔλικας σιδηρᾶς τέσσαρας ἀποτεινομένας ἐπὶ
 πῆχεις δέκα ἔμπροσθεν προσηλοῦντες, καὶ ὄλον ὑποζωννύοντες
 τρισὶ σχοινίοις κατὰ πάχος γυρόθεν ὀκταδακτύλοις, καὶ
 βυρσοῦντες αὐτὸν κύκλω, ἀνελάμβανον κατὰ μέσον ἐκ τριῶν
 10 μὲν διαλειμμάτων, βασταγμάτων δὲ τεσσάρων. Τὰ δὲ σχοινία
 τὰ ἐκ τῶν ὀνίσκων τῶν ἐκ τῆς κριοδόχης ἀνέχοντα καὶ
 ἐπιφέροντα τὸν κριὸν τὰς ἀρχὰς εἶχον ἀλύσεισι σιδηραῖς
 πεπλεγμένας. Ἐποίουν δὲ καὶ ἐπιβάθραν ἐπὶ τῇ προφορᾷ τοῦ
 κριοῦ σανίδος ἔμπροσθεν ἐφηλωθείσης καὶ δίκτυον

25: 1–29 (Ο)ι – τετρακισχιλίων: cf. Ath. Mech. 21:2–26:5.

24: 16 ὑποχαυνώσωμεν Wes: ὑποχαυνώσωμεν VB || 20 μᾶλλον add. Wes (cf. Apollodorus 157:7–8) || 22 < . . . > Wes (cf. Dain, 30) **25:** 12 πεπλεγμένας Wes (cf. Ath. Mech. 25:1): πεπλεγμέναις VB

ened with hairs and <so> kept from cracking. Against the wheels that hold up the tortoise one should place below the lower beams very large wedges that go in under on both sides, to hold up the massive height. For the pins of the wheels alone, and especially if they are short, going through each beam-<pair> like axles, will not be able to lift the tortoise, nor will we keep it standing securely at the coming movement of the ram. The wedges inserted below not only hold up the weight of the high <structure>, but also prevent the slipping of the wheels. Whenever we wish to move the tortoise, we shall loosen the wedges positioned below. You should be aware that stone walls are more quickly shaken and shattered than brick ones. For because of the porousness and softness of the brick, the blow coming from the ram is weak and dissipated, hollowing and pitting the brick rather than shattering and breaking it. But stone, being correspondingly resistant to the hardness of iron < . . . >

25. The <men> of Hegetor of Byzantium made the largest ram, 120 *pecheis* in length, its butt-end 1 *pous* thick, 5 *palaistai* wide; at the front end they narrowed it to 1 *pous* wide and 3 *palaistai* thick. They nailed in front four iron coils that extended 10 *pecheis*, girding the whole thing with three ropes 8 *daktyloi* in circumference and covering it around with ox-hide and suspended it in the middle at three intervals from four suspension <points>. The ropes from the reels of the ram holder, which hold up and swing the ram, were entwined at the front end with iron chains. They also made a scaling-ladder on the forward end of the ram, a board being nailed in front and a plaited net of considerable

15 πεπλεγμένον ἐπὶ πάχος ἱκανὸν κατὰ διάστασιν δακτύλων
 15 τεσσάρων, ἧ καὶ πλείω τὰς ὀπὰς ἔχον, πρὸς τὸ εὐκόλως
 ἀναβαίνειν ἐπὶ τὸ τεῖχος. Ἀνήρτων δὲ αὐτὸν καὶ ἐκίνουν ἐπὶ
 ὀκτατρόχου χελώνης, κατὰ μὲν τὸ τοῦ σχαρίου κάτωθεν μήκος
 πῆχεις ἐχούσης τεσσερακονταδύο, τὸ δὲ πλάτος εἰκοσιοκτῶ. Wes 231
 20 τέσσαρα σκέλη ἐκ δύο ἕκαστα συνημμένων ξύλων ἐποίουν,
 μήκος ἔχοντα ἀνὰ πηχῶν κδ' ἢ καὶ πάχος παλαιστῶν πέντε, κατὰ f. 19v
 δὲ πλάτος πηχυαῖα· ἄνωθεν δὲ τῆς κριοδόχης θωράκιον
 ἐπήγνουον οἰοῦναι περίφραγμα, ὥστε πρὸς αὐτὸ ἀσφαλῶς
 25 τῶν ἐναντίων βαλλόμενα. Τὸν δὲ τοιοῦτον κριὸν ἐξαχῶς ἢ Wes 232
 ἐκίνουν, καθαιροῦντες ἀπὸ ἐβδομηκονταπήχους ὕψους, καὶ
 πρὸς τὰ πλάγια πάλιν ἐπὶ πῆχεις ἐβδομήκοντα παρασύροντες·
 ἐκινεῖτο δὲ ὑπὸ ἑκατὸν ἀνδρῶν προσφερόμενος· τὸ δὲ
 30 Καὶ τὸ σχῆμα ὑπόκειται.

26. Καὶ δεῖ εἰδέναι ὅτι τῶν κριῶν οἱ μὲν ὑπὸ πλήθους ἀνδρῶν
 οἰακίζονται κατὰ τινὰς τῶν πάλαι μηχανικῶν, οἱ δὲ ἐξ
 ἀντισπάστων ἐφέλκονται, καὶ ἕτεροι ἐπὶ κυλίνδρων
 προωθοῦνται. Ἔστιν δὲ ὅτε αὐτοὺς καὶ δι' ὀνίσκων
 5 περιστρεφομένων τὴν τε προσαγωγὴν καὶ ἀναστροφὴν
 ποιουμένους τὴν πληξιν ἀπεργάζεσθαι. Ἔξεστι δὲ τῷ τεχνίτῃ
 πρὸς τὰ τῶν κριῶν μεγέθη καὶ τὴν ἀνήκουσαν τοῦ ἔργου χρεῖαν
 ἐπινοεῖν καὶ τὴν κίνησιν. ἢ f. 20, 20v

27. Ἐὰν θελήσωμεν τὸ σύμπαχον τῶν τειχῶν καταμαθεῖν
 καὶ τὰς γινομένας τῶν πολεμίων πράξεις καὶ τὸ πλήθος ἐκ τῶν
 ὀπισθεν σκοπῆσαι, ἐργασίας καὶ συσκευᾶς ἡμερινὰς τε καὶ
 νυκτερινὰς ἔνδον τοῦ τεῖχους περὶ τὴν πόλιν πραττομένας
 5 θεάσασθαι, σκοπὸν κατασκευάσομεν τοιοῦτον. Δύο ξύλα
 τετράγωνα ἑτεροπλατῆ λαβόντες, πλάτος ἔχοντα ἀνὰ δακτύλων
 δώδεκα, τὸ δὲ πάχος ἀνὰ ὀκτῶ, ὀρθὰ ἐπιστήσομεν τὸ μὲν ἐν

26: 1–4 κριῶν – προωθοῦνται: cf. Ath. Mech. 10:1–2. **27:** 1–92 Ἐὰν – ὀρθωμένον: cf. Apollod. 161:9–164:4.

20 ξύλων VB: σκελῶν Sch

thickness with the openings at intervals of 4 *daktyloi* or even more, for easily climbing onto the wall. They mounted and moved it on an eight-wheeled tortoise whose undercarriage below had a length of 42 *pecheis* and a width of 28. And they made the four legs on the undercarriage, which were attached at the corners upward, each from two beams joined together, with a length of about 24 *pecheis*, a thickness of 5 *palaistai*, and a width of 1 *pechys*. Above the ram holder they affixed a breastwork, like a fence, so that those watching out for objects launched against the ram by the enemy could stand securely on it. They moved such a ram in six directions, creating destruction from a height of 70 *pecheis* and sweeping it to the sides in turn over a distance of 70 *pecheis*. It was brought forward and moved by a hundred men. The entire weight moved was about 4,000 talents. The drawing is below.

<fig. 12>

26. You should be aware that some of these rams are managed by large numbers of men, according to certain ancient engineers, others are dragged by block and tackle, still others pushed forward on rollers. Sometimes they effect their percussion going backward and forward by means of turning reels. The craftsman can also contrive the movement according to the sizes of the rams and the requirement<s> pertinent to the task.

27. If we wish to examine closely the thickness of walls and to inspect the activities of the enemy and their numbers behind the wall, and to view the labors and schemes taking place day and night inside the wall around the city, we shall construct a scout-ladder as follows. Taking two squared beams with unequal sides, about 12 *daktyloi* wide and 8 thick, we shall stand them upright,

μεταξὺ δύο κατὰ κρόταφον κειμένων ἤτοι κατὰ πάχος,
 10 ἕτεροπλατῶν καὶ αὐτῶν ὄντων, ἀποκεχωρισμένων δὲ ἀπ’
 αἰσθητῶν ὅσον κατὰ πάχος χωρηθῆναι τὸ ἰσόρθον· ὡσαύτως δὲ Wes 233
 καὶ τὸ ἕτερον πρὸς ἄλλα δύο ἴσα τε καὶ ὅμοια καὶ ὁμοίως
 κείμενα· ἀπεναντίον δὲ τῶν κειμένων δύο διπλῶν κατὰ μέσον
 ἄλλο πρὸς τῆ γῆ τιθέσθω ἀντικείμενον καὶ συμβαλλόμενον τοῖς
 15 κειμένοις διπλοῖς πρὸς τοῖς ἐφεστῶσι δυσὶν ὀρθοῖς· καὶ
 σχηματιζέσθω ἡ βάσις καθάπερ ἦτα λιτὸν ἐκ πλαγίων
 διπλόγραμμον· ἀπ’ ἄκρων δὲ τῶν κειμένων δύο διπλῶν
 τέσσαρα παραστήσομεν ξύλα, δύο ἐφ’ ἐκάστω, ἀντιβαίνοντα
 ἄνωθεν καὶ ἐπιστηρίζοντα τὰ ἐφεστῶτα ὀρθά· ταῦτα δὲ τὰ ὀρθά
 20 δεχέσθωσαν κατὰ μέσον δύο ἕτερα ξύλα, πλάτους ὄντα ἀνά
 δακτύλων ὀκτώ, κατὰ δὲ πάχος ἀνά ἕξ, ἀπ’ ἀλλήλων ἀπέχοντα
 ποδῶν οὐκ ἔλασσον τριῶν. Ταῦτα δὲ τὰ τέσσαρα τρυπάσθωσαν
 ἢ ἐπὶ εὐθείας πρὸς ἀλλήλα, καὶ συμπερονάσθωσαν τὰ μὲν ὀρθά f. 21
 πρὸς τὸ δίμοιρον αὐτῶν ἐπὶ τὰ ἄνω, τὰ δὲ ἐμβαλλόμενα ἐπὶ τὸ
 ἕκτον αὐτῶν μέρος τὸ πρὸς τὰ κάτω. Κατερχέσθωσαν δὲ ἀπὸ
 25 τῶν ὀρθῶν καὶ πάλιν ἀνερχέσθωσαν ὑπὸ περόνης εὐλύτως
 φερόμενα· τρυπάσθωσαν δὲ καὶ αὐτὰ πάλιν ἀπὸ τῆς περόνης
 ἐπὶ τὸ δίμοιρον αὐτῶν, καὶ ἔστι πρὸς τὸ ἐπίλοιπον ἕκτον μέρος·
 δίμοιρον δὲ τοῦ ὅλου μήκους ἐνταῦθα νόει τὸ μεταξὺ τῶν
 30 τρημάτων πρὸς τὰ ἄκρα γινόμενον, τουτέστι τὸ πρὸς τὰ δύο ἕκτα,
 ἄπερ ποιουσι τρίτον μέρος τοῦ ὅλου μήκους. Ταῦτα τοίνυν
 κατερχόμενα κατὰ μέσον δεχέσθωσαν κλίμακα ἐλαφρὰν
 πεπερονημένην δυσὶ περόναις πρὸς τὰς ῥηθείσας τρήσεις. Οἱ Wes 234
 δὲ τὴν κλίμακα ποιῶντες μηροῖ ἕστωσαν κατὰ πλάτος
 δακτύλων μὴ ἔλασσον ἕξ, ἐπὶ δὲ πάχος τεσσάρων. Ἀπὸ δὲ τῆς
 35 κάτω περόνης τῆς ἐπὶ τῶν ὀρθοστατῶν διεκβληθείσης ἐπὶ τὸ
 ἀναχθὲν ἕκτον μέρος τῶν καταχθέντων ἔλκυστρον ἐμβαλλέσθω
 βαθμίδα τινὰ περιλαμβάνον ἢ σχοινίων δεσμὸν ἢ πρὸς κρίκους
 σιδηροῦς διὰ τὴν ἕλξιν ὑπεμβαῖνον· ξύλον δὲ ἔστι περικαμπές
 τε καὶ εὐτονον, μήκους ὡσεὶ ποδῶν ὀκτὼ πρὸς τὸ ἰκανῶς ἐλκύειν
 40 καὶ κατάγειν διὰ μέσου τῶν ὀρθίων τὸ ἀναχθὲν ἕκτον μέρος· τὸ
 δὲ ἐγκλιθὲν ὅλον σὺν τῇ κλίμακι εἰς ὕψος ἀνάγει μετάρσιον.

27: 8 κρόταφον Wes: κότραφον VB || 12 ἀπεναντίον Wes: ἀπεναντίων VB || 13 ἄλλο Wes:
 ἄλλω VB || 15 λυτὸν Wes || 27 ἔστι Sch: ἔτι VB

one of them between two others that lie on their side, that is, on their thick <side>; these also have unequal sides and are separated from one another enough to leave room for the upright on its thick <side>. And the other <upright> is likewise put between two other beams that are of equal size and form and lying similarly. Another beam should be placed on the ground at the midpoint opposite the two pairs of beams that lie flat, at right angles to and joined with the two pairs that lie flat at the point where the two uprights stand on them. The base should take the form of an uncial *eta* with double lines on the sides. From the ends of the two pairs that lie flat we shall place four posts, two on each <side>, which go up against and support the vertical uprights. Placed between these uprights should also be two other beams, about 8 *daktyloi* wide and 6 thick, no less than 3 *podes* apart. These four <beams> should be drilled on a straight line with respect to one another, and the uprights should be pinned two-thirds of the way up and the <beams> that are being inserted at one-sixth up from their bottom. <The inserted beams should be able to> move down from the uprights and up again, carried freely on a pin. They should also be drilled again up from the pin two-thirds of their <entire length>, <so> there is one-sixth part remaining. Understand that the area there between the drill holes is two-thirds of their whole length compared to the ends, that is, compared to the two one-sixth portions, which form a third of the whole length. These beams that come down should then receive between them a lightweight ladder pinned by two pins at the aforementioned holes. Let the sidebars that form the ladder be at least 6 *daktyloi* wide and 4 thick. From the bottom pin that is inserted through the uprights on the elevated sixth part of the <beams> that have been lowered, a handle should be inserted that connects to a rung or a loop of rope or goes in under iron rings for dragging. This <handle> is a curved and strong post, about 8 *podes* long, for adequately dragging up and bringing down through the middle of the uprights the elevated sixth part; it raises up high into the air the entire inclined part <of the structure> together with the ladder. It will, therefore,

Συμβήσεται οὖν, τοῦ μέρους τούτου ἢ ὑπὸ τοῦ ἐλκύστρου ἐπὶ τὸ
 κάτω ἐλκομένου, ὑπὸ τοῦ ἐτέρου παραδόξως εἰς ὕψος ἀρθῆναι
 τὸν κατάσκοπον, καὶ ὀρθὴν τὴν κλίμακα διαμένειν διὰ τὸ δυσὶν
 45 ἐπεξεῦχθαι περόναις. Δεῖ δὲ τὸ κάτωθεν μέρος ὑπὸ τοῦ
 ἐλκύστρου κρατούμενον, εἰ δυνατὸν, πρὸς τὴν στάσιν
 ἐπέχεσθαι· εἰ δὲ μή, ὑπὸ πλαγίων διερχομένων ξύλων ἢ
 στροφωματίων παρεξοχαῖς ἐγκλειόμενον κατὰ τὸν τῆς στάσεως
 καιρὸν ἀτρεμεῖν. Καὶ δεῖ εἰδέναι ὅτι τὸ ὑπερανέχον τρίτον
 50 μέρος τῶν ὀρθῶν πρὸς ἀσφάλειαν τῶν ἐγκλινομένων ἀνίσταται·
 τὸ δὲ ἀνώτερον ἕκτον μέρος τῶν ἐγκλινομένων, ἤτοι τὸ τοῦ μέσου
 αὐτῶν τέταρτον (ὡς ἀνωτέρω ἐδηλώθη) εἰς ὑποστήριξιν τῆς
 δισσῶς ἄνωθεν πεπερονημένης ἐλαίφρᾶς κλίμακος· τὸ δὲ
 55 κατώτατον αὐτῶν ἕκτον, διὰ τὴν τοῦ ἐλκύστρου πρὸς αὐτὸ
 ἐμβολήν, ἐπὶ τῇ γινομένῃ σφοδρᾷ κάτωθεν ἔλξει, ἅμα δὲ καὶ
 ἐπ' ἀναφορᾷ τοῦ λοιποῦ πενταπλασίου καὶ τῆς κλίμακος,
 παρείληπται. Ἔστω δὲ καθ' ὑπόθεσιν τὸ ὕψος τῶν ἐστώτων
 ὀρθίων, ἕως τοῦ διμοίρου αὐτῶν, ὅσον ἐστὶ τὸ ὕψος τοῦ τρίτου
 60 μέρους τοῦ τείχους· καὶ ἀπ' αὐτοῦ ἄχρι τοῦ διμοίρου τῶν
 ἐγκλινομένων, ἤτοι ἐπὶ τῇ πρώτῃ περόνῃ τῆς συμβολῆς τῆς
 κλίμακος, ὅσον ἐστὶ τὸ τοῦ τείχους ἥμισυ· καὶ αὐτὴ δὲ ἡ κλίμαξ,
 ὅσον τὸ ἥμισυ· τὸ δ' ἐκ τῶν τριῶν συντιθέμενον ὕψος τρίτῳ
 65 μέρει ὑπὲρ τὸ τεῖχος ἀνάξει τὸν κατάσκοπον. Καὶ ἔστι φανερόν.
 ἢ Ἐπεὶ γὰρ τὸ τοῦ τείχους ὕψος σπιθαμῶν ἢ ποδῶν ἢ πηχῶν ἢ
 τινων ἄλλων καταμετρούντων ὑπετέθη ἐξήκοντα, τὰ πρὸς τῇ
 βάσει ὀρθὰ ἐστῶτα ἀνὰ τριάκοντα ἔστωσαν· πρὸς δὲ τὸ ὕψος
 τῶν εἴκοσι τὴν περόνην δεχέσθωσαν· δίμοιρον δὲ τὰ εἴκοσι
 τῶν τριάκοντα. Καὶ τὰ ἀπὸ τῶν ὀρθῶν κατερχόμενα ἀνὰ
 70 τεσσαρακονταπέντε κατὰ μῆκος γινέσθωσαν· ἀπὸ δὲ τῆς
 ῥησθείσης περόνης ἐπὶ τῇ τῆς κλίμακος πρώτῃ συμβολῇ
 ἐναπολαμβανέσθωσαν τριάκοντα· δίμοιρον δὲ ταῦτα τῶν
 τεσσαρακονταπέντε, ὡς ἀνωτέρω προδέδεικται. Ἔστω δὲ καὶ
 ἡ κλίμαξ ἀπ' αὐτῆς τῆς συμβολῆς ἐπὶ τὸ λοιπὸν αὐτῆς ὕψος
 75 ἐτέρων τριάκοντα· τὸ δὲ ἐκ τῶν τριῶν ὑψῶν κατ' ἀριθμὸν
 συναγόμενον ποιεῖ ὀγδοήκοντα· ταῦτα δὲ τῶν ἐξήκοντα τρίτῳ
 μέρει ὑπερέχουσι· τρίτον ἄρα τὰ κ' τῶν ξ'. Γινέσθω δὲ καὶ

Wes 235

f. 22

76 ὑπερέχουσι Sch: ὑπερέχουσι VB

follow that when this part is drawn down by the handle, the observer is wondrously raised upward by the other <end> and the ladder remains upright because it is bound fast by two pins. The lower part must be secured into vertical position, if possible controlled by the handle; if not, it must remain stable while in vertical position, locked on the projections either by beams running through horizontally or by pivots (?). You should be aware that the top third of the uprights rises up to steady the beams that incline, the upper sixth of the beams that incline, that is, the one-fourth of their central section (as was clarified above), to prop up the lightweight ladder which is doubly pinned at the top; their lowest sixth, through the insertion of the handle into it, is used for forcefully dragging from below and simultaneously bringing up the remaining five-sixths and the ladder. Hypothetically let the height of the vertical uprights as far as their two-thirds point be as much as the height of one-third of the wall; and from here to the two-thirds point of the beams that incline, that is, to the first pin of the joint of the ladder, be as much as one-half of the wall. And the ladder itself should be as much as one-half. And the height composed of the three parts will elevate the observer above the wall by one-third. And this is clear. For when the height of the wall has been assumed as 60 *spithamai* or *podes* or *pecheis* or some other unit of measure, the uprights standing on the base should be about 30 units. They should receive the pin at the height of 20; for 20 is two-thirds of 30. And the beams that come down from the uprights should be about 45 units in length. From the aforementioned pin to the first joint of the ladder, 30 units should be encompassed. This is two-thirds of 45, as was shown above. The ladder from the joint itself to its remaining height should be another 30 units. The combination numerically of the three heights makes 80. This exceeds 60 by a third; 20 then is one-third of 60. And a covering of

προστέγασμα ἐπὶ τὸ ἀνώτατον μέρος τῆς κλίμακος ἐκ βύρσης | Wes 236
παχείας τε καὶ εὐτόνου ὡς ἀσπίδος περικαμφθείσης, ἢ ῥάχιν
ὀξειάν κατὰ μέσον δεχόμενον καὶ κλίσιν ἐξαρκούσαν ἐπὶ τὰ
80 πλάγια, πρὸς τὸ ἀπὸ τόξου ἢ σφενδόνης φυλάττεσθαι τὸν
κατάσκοπον. Οὐ μικρὰν δὲ βοήθειαν παρέξουσι καὶ σχοινία
λεπτὰ εὐτόνα, ἐπὶ τοὺς μηροὺς τῆς ἄνωθεν ἐλαφρᾶς κλίμακος
περιειλημμένα, καὶ τετανυσμένα ἄχρι τῆς τῶν περονῶν
συμβολῆς, μήπως ἢ τοῦ ὕψους παράτασις ἢ λιθοβόλου τυχούσα
85 ἢ πληγῆ ῥῆξιν ἢ σπάσιν ἐπὶ τοῖς ξύλοις ποιήσεται καὶ πτωματίση | f. 22v
τὸν κατάσκοπον. Εἰς δὲ τὴν τοῦ σκοποῦ ὀρθίαν καὶ
ἀπαρέγκλιτον στάσιν μέγιστον συμβάλλονται καὶ σχοινία
τέσσαρα ἐπὶ τὰ ἄκρα τῶν ὀρθοστατῶν προσδεδεμένα καὶ | Wes 237
ἀπεκτεταμένα ἀπ' ἐναντίας ἀλλήλων, εἰ ἐνδεθῆσεται σιδηροῖς
90 ἢ ξυλίνοις πασσάλοις μακρόθεν τῇ γῇ ἐμπησομένοις, ἵνα μὴ
διὰ τὸ ὕψος ἀκροβαρῆσαν περινεύση τὸ ἔργον. Καὶ τὰ σχήματα
ὑπόκειται, τό τε κείμενον καὶ τὸ ὠρθωμένον. || f. 23

28. (Γ)ίνεται δὲ ἀπλουστέρα ἢ τοῦ αὐτοῦ σκοποῦ βάσις ἐκ
τριῶν μόνων ξύλων κατὰ πλάτος (πρὸς) τῇ γῇ τιθεμένων, δύο
μὲν πλαγίων ἀπ' ἀλλήλων διεστώτων, καὶ ἐτέρου κατὰ μέσον
ἀπεναντίον συμβεβλημένου, ὡς ἦτα λιτὸν ἀπλόγραμμα
5 ἐσηματισμένων· ἐπάνω δὲ τῶν πλαγίων ὑπὸ γλωσσίδος κατὰ
μέσον τὰ ὀρθὰ ἐφίστανται· ἐκ δὲ τῶν ἄκρων τὰ πρὸς αὐτὰ
ἀντιβαίνοντα δ'.

29. (Γ)ίνεται δὲ καὶ ἄλλως· ἐκ τριῶν ξύλων δύο μὲν πρὸς τῇ γῇ
κειμένων, ἀπ' ἀλλήλων δὲ μικρὸν ἀποκεχωρισμένων ὅσον κατὰ
πλάτος εἰσδέξασθαι τὰ ὀρθὰ· τούτων δὲ τῶν κειμένων διαλόξως
| ἄνωθεν ἀνακεχαραγμένων, καὶ ἐτέρου ἴσου τε καὶ ὁμοίου καὶ Wes 238
5 ὁμοίως κάτωθεν ἀνακεχαραγμένου ἐπ' αὐτῶν κατὰ τὴν θέσιν
ἐφαρμοζομένου, μεταξὺ δὲ τῶν δύο καὶ ἐφ' ἐκάτερα τοῦ
ἐπιτεθέντος λοξοῦ τὰ ὀρθὰ κατὰ πλάτος ἐμβάλλονται· ἀπ'
ἄκρων δὲ τῶν κειμένων ἀντιβαίνοντα δύο ἐπὶ τὰ πλάτη τῶν
ὀρθῶν καὶ δύο ἀπὸ τοῦ λοξοῦ ἐπὶ τὰ πάχη διαλόξως· ἀλλ'
10 οὐδετέρα τούτων ἐστὶν ἀσφαλεστάτη ὡς ἢ προειρημένη. Τὴν
δὲ ἀπ' ἀλλήλων διάστασιν (τῶν) τιθεμένων πλαγίων καὶ τῶν

85 πτωματίση Sch: πτώση V: πώση B: σπάση Wes || **28:** 2 πρὸς add. Sch || 4 λυτὸν Wes ||
29: 11 τῶν add. Wes

thick and strong ox-hide should be <placed> in front at the top of the ladder, like a curved shield, or one with a sharp ridge in the middle and a sufficient inclination to the sides, to protect the observer from bow and sling. And slender, strong ropes will provide no small assistance when bound around the sidebars of the lightweight ladder on top, stretched as far as the joint of the pins, lest the extension of the height or the chance blow of a stone thrower break or convulse the beams and cause the observer to fall. Four ropes will also contribute greatly to the straight and unwavering vertical position of the scout-ladder, when bound to the tops of the uprights and stretched opposite one another, if they are fastened by iron or wooden stakes driven deeply into the earth some distance away, lest due to the height the structure grow top-heavy <and> sway. And the drawings are below, both the flat and the upright view.

<fig. 13>

28. The base of the same scout-ladder is simpler, <if constructed> of only three beams placed on their wide side on the ground, two <beams> on the sides at a distance from each other, and another joined in the middle at right angles, <the three> forming as it were an uncial *eta* written with single lines. The uprights stand on the middle of the side <beams> under a tongue-like strap. From the ends four <braces> go up to them.

29. There is also another way. Of three beams, two lie on the ground, separated a little from each other, enough to receive the uprights on their wide side. Those that lie <on the ground> are cut on top at an angle, and another, equal and similar and similarly cut on its bottom, is fitted in position onto them. And between the two and at either end of the imposed diagonal beam, the uprights are inserted on their wide side. From the ends of the beams that lie <on the ground> two <braces> go up to the wide sides of the uprights, and two from the diagonal beam at an angle to their thick sides. But neither of these is very secure compared to the one mentioned earlier. And the craftsman will determine the distances from one another of the <beams> placed

ὀρθῶν ὁ τεχνίτης διορίσει, πρὸς τὴν τοῦ ὕψους σκοπήσας
 σύνθεσιν τε καὶ συμμετρίαν· ὡσαύτως δὲ καὶ τὰ μεγέθη τῶν
 ζύλων τῆς τε βάσεως καὶ τοῦ ὕψους ἐπὶ τὰς τρεῖς διαστάσεις
 15 κατὰ ἀναλογίαν ἐπαυξήσει τε καὶ μειώσει. ||

f. 23v

30. Διάδης μὲν οὖν καὶ Χαρίας οἱ Πολυείδου τοῦ Θεταλοῦ
 μαθηταί, οἱ συστρατευθέντες Ἀλεξάνδρῳ τῷ Μακεδόνι
 μηχανικοί, πρῶτοι τὰ τε τρύπανα καὶ τὰς διαβάθρας καὶ τοὺς
 φερομένους διὰ τροχῶν ξυλίλους πύργους ἐξεῦρον· καὶ τοὺς
 5 μὲν ἐλάσσονας αὐτῶν πηχῶν πρὸς ὕψος ἐποίουν ἐξήκοντα, τὴν
 δὲ βάσιν ἐτετραγώνιζον, ἐκάστην πλευρὰν τοῦ τε μήκους καὶ
 πλάτους ἀνὰ πηχῶν τιθέντες δεκαεπτὰ, δεκαστέγους αὐτοὺς
 ποιοῦντες, ἐπὶ δὲ τῇ ἀνωτάτῳ στέγῃ συναγωγὴν ἰσοτετράγωνον
 ἀπολαμβάνοντες, κατὰ ἀναλογίαν τοῦ τῆς βάσεως πέμπτου

10

Wes 239

μέρους τοῦ λεγομένου ἐμβαδοῦ, ἥτοι τοῦ ἰὺπὸ τῶν τεσσάρων
 πλευρῶν περιοριζομένου χωρίου, ὡς ἐφεξῆς δηλωθήσεται. Τοὺς
 δὲ μείζονας καὶ ἡμιολίους τούτων πεντεκαίδεκαστέγους
 ἐποίουν, ὕψος δὲ πηχῶν 4'· καὶ ἔτι τοὺς διπλασίους
 εἰκοσαστέγους πρὸς ὕψος πηχῶν ρκ'· ἐκάστην δὲ πάλιν πλευρὰν
 15 τῆς τῶν διπλασίων βάσεως ἀνὰ πηχῶν κδ' ἔγγιστα. Καὶ μείζονάς
 τε καὶ ἐλάσσονας κατὰ ἀναλογίαν κατεσκευάζον, ἐπὶ τὰς τρεῖς
 διαστάσεις τὰ ζύλα αὐξάνοντες ἢ μειοῦντες, τουτέστι κατὰ τε
 μῆκος πλάτος τε καὶ πάχος· ὡσαύτως δὲ καὶ τὰς τῶν στεγῶν
 διαιρέσεις πρὸς τὴν τοῦ ὕψους κατεμέριζον συμμετρίαν.

20

f. 24

Ἐξατρόχους αὐτούς, ἐνίοτε δὲ καὶ ὀκτατρόχους πρὸς || τὸ
 ἔξογκον τοῦ μεγέθους ἐποίουν· ἐπὶ πάντας δὲ ἀεὶ τὸ τῆς βάσεως
 πέμπτον μέρος ἀνωθεν ἐπετίθουν.

31. Ὁ δὲ Ἀπολλόδωρος, σεμνότερον πρὸς πόδας
 κατασκευάζων τὸν πύργον, ὑφημιόλιον αὐτὸν τῶν ἐξήκοντα
 πηχῶν καὶ τετράτροχον δηλοῖ, ποδῶν πρὸς ὕψος ἐμφαίνων
 ἐξήκοντα· ὅθεν καὶ αὐτὸς ἐκάστην τὴν περὶ τὴν βάσιν πλευρὰν
 5 κατὰ μῆκος ποδῶν ἐποίει δεκαέξ, δίχα τῆς ποδιαίας ἐπὶ τὰ ἄκρα

30: 1–4 Διάδης – ἐξεῦρον: cf. Ath. Mech. 10:10–12. 4–19 καὶ – συμμετρίαν: cf. Ath. Mech. 11:3–12:10. **31:** 1–32 Ὁ – καλείσθωσαν cf. Apollod. 164:8–165:10.

30: 1 Πολυείδου Mar: Πολυίδου VBP || 5 ὕψος B: ὕψους V || 13 ὕψος B: ὕψους V || 16 τε Sch: δὲ VB || 22 ἐπετίθουν VB: ἀπετίθουν Sch

on the sides and of the uprights by considering the composition and commensurability of the height; in a similar manner will he increase and decrease the sizes of the beams of the base and of the height proportionally for the three dimensions.

<fig. 14>

30. Diades and Charias, the students of Polyeides the Thessalian, engineers who campaigned with Alexander of Macedon, first invented borers and drop-bridges and wooden towers carried on wheels. They used to make the smaller of these 60 *pecheis* in height and the base square, setting each side, length and width, at about 17 *pecheis*, making them ten stories; on the top story they contracted it equally on all sides, in a proportion of one-fifth of the so-called area of the base, that is, the place delimited by the four sides, as will be shown in what follows. They made some others larger than these, one and a half times <as large> and fifteen stories, 90 *pecheis* high; and even double, twenty stories, to a height of 120 *pecheis*; <they used to make> each side in turn of the base of the doubled ones approximately 24 *pecheis*. And they constructed them larger and smaller, proportionally increasing or decreasing the timbers for the three dimensions, that is, in length, width, and depth; in a similar manner they partitioned the divisions of the stories commensurably with the height. They made them on six wheels, sometimes even on eight on account of the very massive size; but for all they always imposed at the top one-fifth of the base.

31. And Apollodorus, constructing his tower smaller, <reckoning> in *podes*, makes clear it is two-thirds of 60 *pecheis* and four-wheeled, indicating 60 *podes* in height. Whence he made each side around the base 16 *podes* in length (apart from the 1-*pous*

παρεξοχῆς, πλάτους ποδὸς ἐνὸς καὶ δακτύλων τεσσάρων, κατὰ
 δὲ πάχος δακτύλων δώδεκα, διπλᾶ τὰ κάτω ζυγὰ ποιῶν, ὅπου
 οἱ τροχοὶ πρὸς τὸ μέσον, οἱ δὲ μεσοστάται ἐπὶ ταῖς παρεξοχαῖς
 ἐμβάλλεσθαι μέλλουσι. Ταῦτα τὰ δύο καὶ δύο ζυγὰ κατὰ πάχος
 10 ἐτίθει, καὶ μεταξὺ πρὸς ἕκαστα δώδεκα δακτύλων μεσόχωρον Wes 240
 εἶτε καὶ μείζον ἐπὶ τὰ πλάτη διϊστῶν, ὀρθοὺς ἐπὶ τὰ ἄκρα τοὺς
 μεσοστάτας ἐμβάλλει μέχρι τοῦ ἐδάφους κατερχομένους, οὓς
 τινες σκέλη τοῦ πύργου ὠνόμασαν, ποδῶν πρὸς ὕψος ἀνά δεκαεξ
 ὄντα, πλάτους ποδὸς ἐνὸς καὶ δακτύλων τεσσάρων, κατὰ δὲ
 15 πάχος ἀνά δακτύλων δώδεκα· ταῦτα πρὸς τοῖς κειμένους διπλοῖς
 διὰ κανονίων περιτομίδων τε καὶ χελωνίων, ἥτοι ἡμισφαιρίων
 περὶ τὸ μέσον ἐγγεγλυμμένων καὶ ὡς γρονθαρίων τινῶν
 ἐκκεκομμένων, παρομοίων τοῖς ἐπὶ τῶν στρομφίγγων τῶν θυρῶν
 20 τιθεμένοις, περὶ τὴν προσηλωσιν ἀσφαλίζεται, ἵνα μένωσιν
 ὀρθά. Τοῖς ὀρθίοις τούτοις σκέλεσιν μεσοστάταις οὖσιν ἀπὸ τῶν
 κειμένων διπλῶν ἐπὶ τὰ ἀντικείμενα διπλᾶ ἕτερα ξύλα ἴσα ὄντα
 κατὰ μῆκος ὡς ἀντιζυγίδας ἐτίθει, ἰσοτετράγωνον τὸ τοῦ πύργου
 σχηματίζων σχάριον, ἥτοι τὴν βᾶσιν ἐξ ἴσου περιορίζων, ἵνα
 οἱ ῥηθέντες τέσσαρες μεσοστάται ἴσον ἀπ' ἀλλήλων
 25 πανταχόθεν ἀπέχωσιν· ἐφ' ἐκάστῳ δὲ τῶν τεσσάρων δύο
 παρίστανεν ξύλα ἀριθμῶ ὄντα ὀκτώ, ἰσοπλατῆ τούτων καὶ
 ἰσοπαχῆ, ὕψους ἀνὰ ποδῶν ἐννέα, ἐφεστῶτα δὲ καὶ
 παριστάμενα τῶν μεσοστατῶν ἐφ' ἐκάτερα ἐπὶ τὰ κείμενα
 διπλᾶ καὶ προσηλούμενα καὶ αὐτὰ ἀσφαλῶς (ὡς προεῖρηται)
 30 πρὸς τε τὰ ζυγὰ καὶ τοὺς μεσοστάτας· καὶ οὕτως τὰ τρία
 συνίστανεν ἐν τάξει ὀρθοστάτου ἐνὸς κατὰ μέσον
 ὑπερανέχοντος. Ταῦτα δὲ τὰ ὀκτὼ παραστάται καλεῖσθωσαν.
32. Καὶ ἐπεὶ δυσεύρετοί εἰσι διὰ τὸ τοῦ πλάτους μέγεθος οἷ τε
 μεσοστάται καὶ παραστάται, ἀνάγκη τοῖς περὶ Διάδην καὶ
 Χαρίαν ἐπεισθαι καὶ ἰσοτετράγωνα ἀνὰ δώδεκα δακτύλων τὰ
 5 σκέλη κάτωθεν ποιεῖν, ἄνωθεν δὲ ἐλάσσονα· ἐξαιρέτως δὲ τὰ
 παριστάμενα, καὶ μάλιστα πρὸς κατασκευὴν μεγέθους τοιούτου
 πύργου σύμμετρα τυγχάνοντα.

32: 3–4 καὶ – ἐλάσσονα: cf. Ath. Mech. 12:2–4.

31: 16 περιστομίδων Sch

projection at the ends), 1 *pous*, 4 *daktyloi* wide and 12 *daktyloi* thick, making the bottom timbers double, where the wheels are going to be inserted in the middle of them and the center-stanchions <inserted> on the projections. These double timbers he placed on their thick sides and between each <pair>, leaving open a gap of 12 *daktyloi* or even more in breadth, he inserts the center-stanchions upright at the ends; these, which some call the tower's "legs," go down as far as the bottom. They are 16 *podes* high, 1 *pous*, 4 *daktyloi* in width, about 12 *daktyloi* thick. These are secured to the horizontal double <timbers> at the point of fastening with little crossbars, angle braces, and shell-caps, that is, hemispheres hollowed out in the center and like some cutout little fists, similar to those placed on door pivots, to keep them upright. And at these upright legs that are center-stanchions, he placed, from the double horizontal timbers to the opposite double timbers, other timbers equal in length as transversals, forming the equal-sided undercarriage of the tower, that is, equally delimiting the base in order that the aforementioned four center-stanchions be equidistant from one another at all points. Next to each of the four <center-stanchions> he stood two <other> stanchions, eight in <total> number, with width and thickness equal to the others, 9 *podes* high. These stand next to the <center->stanchions on either side and stand on the horizontal double timbers and are also nailed securely (as mentioned above) to the timbers and the center-stanchions. And so he stood the three in order together with one upright in the middle taller <than the others>. Let these eight be called side-stanchions.

32. And since the center-stanchions and the side-stanchions, on account of their great width, are hard to find, it is necessary to follow the <men> of Diades and Charias and make the lower legs about 12 *daktyloi* square, but those above smaller, especially the side-stanchions, and above all commensurate for the construction of a tower of such size.

33. Πρὸς αὐτὰ δὲ πάλιν ἄνωθεν ὁ προρρηθεὶς Ἰ Ἀπολλόδωρος ὁμοίως τοῖς κάτω ζυγὰ καὶ ἐπιζυγίδας ἐτίθει ἐλάσσονας τῷ μήκει ποδὸς ἄχρι, καὶ ἕως τῆς ἀνωτάτω στέγης πρὸς τε μήκος καὶ πλάτος ἐκ τῶν τιθεμένων ἀνὰ πόδα ἀφήρει, ἵνα συναγωγὴν
 5 ἄνωθεν ὁ πύργος λάβῃ, μήπως ἀκροβαρήσας περινεύσῃ, ἀλλ' ἀσφαλῆ τὴν στάσιν ἐκ τοῦ κάτωθεν πλάτους τῆς ἕδρας ἔξῃ. Τῶν δὲ στεγῶν αἱ μὲν περιίπτεροι ἔστωσαν, αἱ δὲ περιδρόμους κύκλω ἔχουσαι πλάτους ὡσεὶ ποδῶν τριῶν· χρειώδεις γὰρ εἰσιν εἰς τὴν τῶν ἐμπρησμῶν ἐκβοήθησιν. Καθ' ὃ δὲ διέστηκεν ἐπὶ τὰ πλάτη
 10 τὰ κάτω ζυγὰ τὰ τοὺς μεσοστάτας δεξάμενα ἐπὶ τὰ ρηθέντα δωδεκαδάκτυλα ἢ καὶ μείζονα μεσόχωρα, τῷ τεχνίτῃ ἐμφαίνων ἐντέλλεται τροχοὺς ἐμβάλλειν τέσσαρας ἐξ εὐτόνων ἀξόνων συμπεπερονημένους καὶ σιδηροῖς πετάλοις ψυχρηλάτοις συνδεδεμένους, τὴν διάμετρον ἔχοντας ἦτοι τὸ ὕψος ποδῶν ὡσεὶ
 15 τεσσάρων ἡμισυ· συμπερονᾶσθαι δὲ ὅτῃ τοὺς αὐτοὺς τροχοὺς καὶ διὰ σιδηρῶν βραχέων ἀξόνων, διὰ τε τὸ ἐπικείμενον βᾶρος καὶ τὸ ἔξογκον τοῦ μεγέθους· καὶ τοὺς μὲν δύο πρὸς ἕκαστα μόνα τὰ δύο ξύλα ἀσφαλίζεσθαι, τοὺς δὲ λοιποὺς δύο πρὸς τὰ ἐξ ἐναντίας ἀντικείμενα αἶροντας ἀπὸ τῆς γῆς καὶ ἰ ἀνέχοντας τὰ
 20 διπλᾶ ξύλα, ἵνα εὐστρόφως οἱ τροχοὶ καὶ ἀπαρεμποδίστως κυλίωνται καὶ ὅλον συγκινῶσι τὸ τοῦ πύργου σύμπηγμα.

Wes 242

34. Οὕτως οὖν τῆς κατασκευῆς Ἰ συνισταμένης ἠύρισκοντο οἱ πρῶτοι μεσοστάται τρίτῃ ἐαυτῶν μήκους μέρει ἐπὶ τῇ ἀνωτέρᾳ στέγῃ ἀνέχοντες. Ὅθεν παραστάτας ἐπὶ τὰ ἀνώτερα ζυγὰ πάλιν ἐτίθει ὑπερέχοντας τοῦ μεσοστάτου, καὶ πρὸς αὐτὸν ἄλλον
 5 συνεχόμενον ὑπὸ τῶν παραστατῶν, καὶ οὕτως κατὰ πᾶσαν στέγην τετραμερῶς συμπλέκων τὸν πύργον ἐστήριζεν. Καὶ τὸν μὲν πρῶτον μεσοστάτην οὐκ ἐποίησε τοῖς παραστάταις τούτοις ἴσον, ἵνα μὴ αἱ συμβολαὶ αὐτῶν ἐγγὺς ἀλλήλων ὦσιν, ἀλλ' ἀντιπαραλλάσσει πᾶς ἀρμὸς ἀφεστηκῶς πρὸς τὸν ἕτερον, καὶ
 10 τῇ τῶν παρακειμένων συνοχῇ καὶ ἐνότητι ἰσχὺν λαμβάνῃ. Καὶ κλίμακας δὲ πρὸς τὰς ἐπιζυγίδας διὰ τὴν ἀνάβασιν παρετίθει

f. 25v

33: 1–**34:** 20 Πρὸς – πύργωμα: cf. Apollod. 165:11–167:9.

33: 12 τέσσαρας ἐξ εὐτόνων V: τέσσαρας ἐξ εὐτόνου B: δι' ἐξευτόνων Sch ἢ 15 ὅτε Sch: ὅτε VB

33. And upon these <uprights> the aforementioned Apollodorus in turn placed above timbers like those below and cross-timbers, shorter in length up to a *pous*. And up to the top story he decreased the <stories> placed there by a *pous* in length and width, in order that the tower might be contracted above, lest in any way it become top-heavy <and> sway, but rather that it might stand securely due to the width of the lower base. And some of the stories are surrounded by ledges, others have galleries around them of about 3 *podes* in width; for these are needed for protection against burning. Where the lower timbers that receive the center-stanchions are separated in breadth by the aforementioned gaps of 12 *daktyloi* or even more, Apollodorus indicates <and> bids the craftsman to insert four wheels pinned from strong <wooden> axles and secured with cold-forged iron plating — the wheels have a diameter, that is, a height, of about $4\frac{1}{2}$ *podes*; <and> sometimes that the same wheels are pinned also with short iron axles on account of the imposed weight and very massive size and these are secured two to each individual pair of timbers, but the remaining two to the opposite timbers on the other side, raising from the earth and holding up the double timbers, so that the wheels may roll easily and without hindrance and move the whole superstructure of the tower.

34. Therefore, when the construction is arranged in this way, the first center-stanchions are found to rise above the next story by a third part of their length. Whence <Apollodorus> in turn placed side-stanchions on the upper timbers, taller than the center-stanchion, and on top of this <center-stanchion> another one, encompassed by the side-stanchions; and thus weaving at the four corners on every story he stabilized the tower. And he did not make the first center-stanchion equal to these side-stanchions, lest their joints be near one another, but rather that every connection might alternate, separate with respect to the other, and obtain strength by the joining and unity of the side-stanchions. And on the cross-timbers he placed ladders for ascending

τὸ ἕτερον ἐκ τοῦ ἐτέρου πλευροῦ διαγωνίως χωρίζουσας.
 Ἐσφαλίζετο δὲ τὸν πύργον καὶ σχοινίοις ἄνωθεν κατὰ τὰς
 γωνίας δεδεμένοις καὶ κατὰ μέσον ἕξω ἐπισυρομένοις,
 15 πλατυτέραν ἐν σχήματι βάσιν τῷ πύργῳ ἐμποιῶν οἰονεὶ ἔδραν,
 περιδεδεμένοις πασσάλοις περόνας ἔχουσιν ἢ σιδηροῖς ἥλοις
 καὶ κρίκοις, πλαγίοις πρὸς τὴν ἀπότασιν ἐμπησσομένοις, οὐ
 μικρὰν βοήθειαν διὰ τῆς τῶν σχοινίων τάσεως πρὸς ὑποστήριξιν
 τῷ πύργῳ παρεχόμενος. Οὕτως ἐξ ὀλίγων καὶ μικρῶν ξύλων μέγα
 20 καὶ ἰσοῦσές τῷ τείχει κατεσκευάζε πύργωμα, ἢ (μ)ῆτε στεγῶν f. 26, 26v
 διαιρέσεις ἢ ἢ ὕψη σημάνας, μήτε τῆς ἄνωθεν συναγωγῆς τὸ Wes 243
 πέμπτον μέρος δηλώσας.

35. Εἰ δέ τις ἀπορῶν ἐπιζητοίη τοῦτο, ἐκ τῆς κάτωθεν βάσεως
 λήψεται διὰ τοῦ ὑποτεθέντος ἐφ' ἐκάστη πλευρᾷ ἀριθμοῦ. Ἐπεὶ
 γὰρ ἡ πλευρὰ ποδῶν ἐδόθη δεκαέξ, πολλαπλασιαζομένη δὲ ἐπὶ
 τὴν ἐτέραν καὶ ἰσομήκη αὐτῆς ποιεῖ τὸ ὅλον ἐμβαδὸν ἦτοι τὸ
 5 ἔνδον τοῦ τετραπλεύρου χωρίον ποδῶν σνς', καὶ ἔστι τούτων
 τὸ πέμπτον ποδῶν να' πέμπτον ἔγγιστα· ζητῶ ποῖος ἀριθμὸς ἐφ'
 ἑαυτὸν ἢ ἐπὶ τὸν ἰσομήκη αὐτοῦ πολλαπλασιαζόμενος τοῦτον
 ποιεῖ, καὶ εὕρισκω τὸν ἐπτὰ ἕκτον ἔγγιστα· ἐπτὰ γὰρ ἐπὶ ἐπτὰ
 10 λεπτὰ πρῶτα ο'· πάλιν δὲ τὰ ι' ἐπὶ ζ' (ποιουῖσιν) ο'· καὶ ἐκ τῶν
 συναγομένων λεπτῶν πρώτων ρμ' τὰ μὲν ρκ' εἰς πόδας δύο
 καταλογίζεσθαι, τὰ δὲ λοιπὰ εἰς τὸ μέρος· ὥστε τὰ πρὸς τῇ
 συναγωγῇ τῆς ἀνωτάτω στέγης τιθέμενα ζυγὰ ἀνὰ ποδῶν ἐπτὰ
 15 ὕψος ἀπὸ τῆς κάτωθεν βάσεως τιθέμενα ἐννέα στέγαι ἐπὶ τὴν
 τοῦ μήκους καὶ πλάτους ἐπέμβασιν κατὰ τὸν τοῦ τετραπλεύρου
 περιορισμὸν ἀνὰ πόδα ἀφαιροῦσαι ἐκ τῶν δεκαέξ, ἐπτὰ ἔγγιστα
 καταλιμπάνουσιν. Ἡ αὐτὴ δὲ ἔφοδος ἢ ἐπὶ τῆς ἀνωτάτης τοῦ Wes 244
 πύργου συναγωγῆς καὶ ἐπὶ τρίτου καὶ τετάρτου καὶ ἢ τοῦ f. 27
 20 τυχόντος μέρους αἰεὶ τοῖς ἐπιζητοῦσιν ἔστω.

36. Τὰς δὲ τῶν στεγῶν διαιρέσεις καὶ τὰ πρὸς ὕψος
 ἀναστήματα οἱ μὲν περὶ Διάδην καὶ Χαρίαν πρὸς πῆχεις

36: 1–9 Τὰς – ἐλάμβανεν: cf. Ath. Mech. 12:6–10.

34: 20 μήτε B: ητε V ἢ **35:** 10 ποιουῖσιν add. Wes ἢ 13 συναγωγῇ Wes: συναγωγῆς VB

<the structure>, which diagonally separated one side from the other. He secured the tower also with ropes tied on top at the corners and in the middle, stretched outward, making a base for the tower broader in form, like a foundation, and bound to stakes with pins or to iron spikes and rings, fixed transversely against the tension. He furnished no little aid for the support of the tower through the tension of the ropes. Thus from a few small beams he constructed a large tower equal in height to the wall. He specified neither the divisions nor the height of the stories, nor indicated the one-fifth contraction on top.

<fig. 15>

35. If someone who is in doubt should seek this, he will obtain it from the lower base through the number proposed for each side. For when the side has been given as 16 *podes*, multiplied by the other side which is its equal, this makes the total area, that is, the inner space of the four-sided figure, 256 <square> *podes*, and one-fifth of these *podes* are approximately $51\frac{1}{5}$ *podes*. I ask what number multiplied by itself or by a length equal to it makes this <amount> and I find approximately $7\frac{1}{6}$: for 7 times 7 <is> 49; and 7 times $\frac{1}{6}$, that is times 10 minutes < $\frac{10}{60}$ >, makes 70 minutes < $\frac{70}{60}$ >; and again 10 <minutes> by 7 makes $\frac{70}{60}$. And from the summed 140 minutes < $\frac{140}{60}$ >, 120 <minutes> are converted into 2 *podes*, and the remainder to the fraction < $\frac{20}{60}$ >. So the timbers set in place for the contraction of the top story should be approximately $7\frac{1}{6}$ *podes* in length. But also the nine stories positioned upward from the lower base, reduced from the <original> 16 *podes* by a *pous* with <each> modulation (?) of length and width in the delimiting of the four-sided <figure>, leave approximately 7 *podes*. And the same method for the uppermost contraction of the tower should always be <employed> for the third and fourth and any part by those who seek it.

36. The <men> of Diades and Charias, counting the divisions of the stories and the elevations upward in *pecheis*, used to place

ἀριθμοῦντες τὴν ἐκ τῆς κάτωθεν βάσεως πρώτην στέγην πηχῶν
 πρὸς ὕψος ἐτίθουν ἑπτὰ καὶ δακτύλων δώδεκα· τὰς δ' ἀνωτέρας
 5 πέντε ἀνὰ πηχῶν πέντε μόνον· τὰς δ' ὑπολειπομένας ἀνὰ
 τεσσάρων καὶ τρίτου, τό τε σύμπαχον τοῦ καταστρώματος τῶν
 στεγῶν καὶ τὸ κάτωθεν τοῦ σχαρίου σὺν τῷ ἄνωθεν ἀετώματι
 τῷ ὕψει συνηρίθμουν. Ὁμοίως δὲ καὶ ἐπὶ τοῦ ἐλάσσοнос πύργου
 ἢ διαίρεσις τῶν στεγῶν τὸν αὐτὸν λόγον πρὸς ὕψος ἐλάμβανεν.

37. Ὁ δὲ ῥηθεις Ἀπολλόδωρος, πρὸς πόδας καταριθμῶν τὸν
 πύργον, τοὺς ἐκ τῆς βάσεως πρώτους παραστάτας ποδῶν ἐννέα
 πρὸς ὕψος ποιεῖ· καὶ εἰ μὲν ἰσοῦψεῖς πάντας βούλεται,
 ἐξάστεγον αὐτὸν δηλοῖ καὶ ποδῶν ἕξ μόνων τὴν παρέμβασιν
 5 εἶναι· τρίτον δὲ καὶ εἰκοστὸν ἔγγιστα τοῦ ἐμβαδοῦ τῆς βάσεως
 ἐπισυνάγει ἄνωθεν ἀνὰ δέκα ποδῶν καὶ τὰ ἀνώτερα τιθεὶς ζυγά.
 Εἰ δὲ τὸ πέμπτον τῆς βάσεως ἐπὶ ἐξαστέγου πύργου ἐπισυνάγει
 ἄνωθεν, ἐνὸς καὶ ἡμίσεως ποδὸς τὴν τῶν στεγῶν ἐπέμβασιν
 τετραμερῶς ἐμφαίνει· εἰ δὲ καὶ δεκάστεγον, ἀνὰ ποδὸς ἐνὸς τὴν
 10 παρέμβασιν, ὡς προεῖρηται, καὶ πέμπτον τῆς βάσεως
 ἀπολαμβάνειν ἄνωθεν, ὡς ἂν καὶ τὰ ἀνώτερα ζυγά ἢ ἀνὰ ποδῶν
 ἑπτὰ καὶ μέρους ἕκτου ποιεῖν. Καὶ ἐπὶ μὲν δεκαστέγου τοὺς
 κάτωθεν παραστάτας ἀνὰ ποδῶν ἐννέα γίνεσθαι, τοὺς δ' ἐπὶ
 ταῖς ἀνωτέραις τέτρασι στέγαις ἀνὰ ποδῶν ἕξ μόνων, τοὺς δ'
 15 ἔτι ἀνωτέρους ἐπὶ ταῖς ὑπολοίποις τέτρασιν ἀνὰ πέντε καὶ
 μέρους.

38. Οὕτως οὖν οὐ μόνον αἱ κατ' ἀριθμὸν διαφέρουσαι τῶν
 πύργων στέγαι πρὸς ἐξήκοντα ποδῶν ὕψος ἰσοῦψεῖς
 εὐρεθήσονται, ἀλλὰ καὶ οἱ ἐξ ἀμφοτέρων πρὸς πήχεις καὶ πόδας
 κατασκευαζόμενοι πύργοι καὶ κατὰ μέγεθος διαφέροντες
 5 σύμμετροι πρὸς ἀλλήλους κατὰ ἀναλογίαν δειχθήσονται. Εἰ
 γὰρ ὁ πῆχυς εἰκοσιτεσσάρων κατὰ μῆκός ἐστι δακτύλων, τοῦ
 ποδὸς ἐξκαίδεκα ὄντος, ἔχει δὲ ὁ κδ' τὸν δεκαῆξ καὶ τὸ ἡμισυ
 αὐτοῦ, ἡμιόλιος αὐτοῦ ἐστίν, ὑφημιόλιος δὲ πρὸς πήχυν ὁ πούς·
 ὥστε καὶ αἱ τοῦ ὕψους πήχεις ἐξήκοντα καὶ αἱ τῆς βάσεως τοῦ
 10 μήκους δεκαεπτὰ τὴν αὐτὴν ἀναλογίαν πρὸς τοὺς πόδας
 ἔξουσιν, ὡσαύτως δὲ καὶ τὴν ἐν λόγοις συμφωνίαν, ὅτι κοινῶ

Wes 245

f. 27v

36: 6 σύμπαχον VBP: σύμπαν πάχος Mar ἢ **38:** 7 τὸν Wes: τῶν VB

the first story on the lower base at a height of 7 *pecheis* 12 *daktyloi*; and the <next> five higher ones at only 5 *pecheis*; the remaining ones at $4\frac{1}{3}$ <*pecheis*>. And they included in their calculation of the height the entire thickness of the deck of the stories, and the undercarriage at the bottom and the gable on top. Likewise for the smaller tower also the division of the stories had the same ratio with respect to the height.

37. The aforementioned Apollodorus, reckoning his tower in *podes*, makes the first side-stanchions on the base 9 *podes* high; and if he wants them all to be of equal height, he makes clear it is six stories and the modulation (?) is only of 6 *podes*. And he encloses on top approximately 23 <minutes> < $\frac{23}{60}$ > of the area of the base, placing further up timbers of 10 *podes*. And if he encloses on top one-fifth of the base on the six-story tower, he indicates that the modulation (?) of the stories at the four sides is $1\frac{1}{2}$ *podes*. But if it is a ten-story one, the modulation (?) is 1 *pous*, as already mentioned, and intercepts on top a fifth of the base, as this would make the upper timbers about $7\frac{1}{6}$ *podes*. And for the ten-story tower, the lower side-stanchions are of 9 *podes*, those on the next higher four stories of only 6 *podes*, and those still higher on the remaining four <stories> are $5\frac{1}{4}$ *podes*.

38. So, therefore, not only will the towers <of Apollodorus> with different numbers of stories be found equal to 60 *podes* in height, but even the towers constructed by both groups, by *pecheis* and by *podes* and differing in size, will be shown to be commensurable with one another in proportion. For if the *pechys* is 24 *daktyloi* long, the *pous* being 16, but twenty-four is sixteen and half again of it, then <the *pechys*> is one and one-half times <the *pous*>, the *pous* two-thirds of the *pechys*. Thus 60 *pecheis* of the height and 17 of the length of the base will have the same proportion in *podes*, and so also be harmonious in ratios, because

μέτρῳ ἀμφοτέροι μετροῦνται. Ὅγὰρ τριάκοντα τρίς μὲν μετρεῖ
 τὸν 4', δις δὲ τὸν ἑξήκοντα καὶ πάλιν ὁ ὀκτὼ τρίς μὲν τὸν κδ'
 μετρεῖ, δις δὲ τὸν ις'· καὶ ἔστιν ὡς 4' πρὸς 8', οὕτως κδ' πρὸς
 15 ις'· καὶ ὡς κδ' πρὸς ις', οὕτως καὶ οἱ τροχοὶ πρὸς ἀλλήλους κατ'
 ἀριθμὸν τε καὶ μέγεθος, καὶ ἡ βάσις πρὸς τὴν βάσιν, ὡς καὶ τὰ
 τρία πρὸς δύο. Ἐδείχθησαν ἄρα καὶ ἡ οἱ μετροῦντες πρὸς f. 28
 ἀλλήλους τὸν αὐτὸν τοῖς μετρουμένοις κατ' ἀναλογίαν ἔχοντες Wes 246
 λόγον· ὥστε οὐ μόνον πρὸς συμμετρίαν, ἀλλὰ καὶ συμφωνίαν
 20 τῶν φορητῶν πύργων κατασκευὰς οἱ περὶ Ἀπολλόδωρον πρὸς
 τοὺς περὶ Διάδη καὶ Χαρίαν εὐρίσκονται ποιοῦντες. Καὶ
 φανερόν ὅτι οἱ πάλαι μηχανικοὶ καὶ πολυμαθέστατοι
 ἀρχιτέκτονες ἐπιστημονικῶς καὶ οὐκ ἀλόγως τὰς τῶν
 μηχανημάτων κατασκευὰς ἐποίουν.

39. (Τ)οῦ πύργου οὕτως ἐπὶ τῇ κατασκευῇ τελεσθέντος, ἐὰν
 μὴ ὁμαλὸς καὶ ἰσοπέδιος ὁ πρὸς τὴν βάσιν ὑποκείμενος εἴη τόπος
 ἀλλ' ἀνωφερὴς τυγχάνη, ποιήσομεν ὑπόθημα πρὸς τῇ βάσει
 τοῦ πύργου τῇ ὁμοίᾳ αὐτοῦ συμπλοκῇ ἐπὶ τῷ ἀνωμάλῳ τῆς γῆς
 5 προσερχομένη καὶ πλατυνούση τὸν ὑποκείμενον κάτωθεν τόπον,
 ὅπως ἐπὶ τῇ συμβολῇ καὶ τῷ κλόνῳ τῆς μάχης ἀκλινῆς πρὸς τὴν
 στάσιν ὁ πύργος συντηρηῖται. Διαφυλαχθήσεται δὲ πρὸς τὸ μὴ
 καίεσθαι ἐκ τῶν πεμπομένων πυροφόρων τριβόλων καὶ
 ἀναπτομένων φλογῶν προσηλούμενος σανίσι, μάλιστα μὲν
 10 φοινικίναις ἢ ταῖς ἐξ εὐτόνων ξύλων γινομέναις, πλὴν κεδρίνων
 πευκίνων τε καὶ κληθρίνων, διὰ τὸ ἔκφυρον αὐτῶν εὐκλαστόν
 τε καὶ εὐθραυστον. Ἐπικρεμάσθωσαν δὲ καὶ δέρματα τῷ πύργῳ
 ἐπὶ τοῖς ῥηθείσιν ἐπὶ τῇ κατασκευῇ περιπτέροις τε καὶ
 περιδρόμοις, μὴ προσεγγίζοντα ἢ ταῖς σανίσιν, ἀλλὰ μικρόν Wes 247
 15 ἔξωθεν ἀπέχοντα διὰ τε ἡ τὰ πυροβόλα καὶ ὅπως ἀσθενεῖς πρὸς f. 28v
 αὐτὰ καὶ ἔκλυτοι ἐπὶ τῇ τῆς βολῆς ἐνδόσει αἱ τῶν λιθοβόλων
 πρὸς τὸ χανῶν γίνονται πληγαί. (Π)ροσηλούσθω δὲ καὶ ἥλοις
 ὁ πύργος ἀνωθεν, ὡς προεῖρηται καὶ ἐπὶ τῶν χελωνῶν, καὶ πηλοῦ

38: 17 μετροῦντες: cf. Euc. IX:11. **39:** 1–5 ἐὰν – τόπον: cf. Apollod. 173:9–12. 8–12 ἐκ – εὐθραυστον: cf. Ath. Mech. 17:14–18:1. 8 πυροφόρων τριβόλων: cf. Philo Mech. 94:9–10, 95:8, 100:20–21. 12–30 Ἐπικρεμάσθωσαν – τόπον: cf. Apollod. 173:13–174:7.

20 Ἀπολλόδωρον Wes: διόδωρον VB || **39:** 3 ποιήσομεν Wes: ποιήσωμεν VB || 13 περιπτέροις Sch: παραπτέροις VB || 17 γίνονται Wes: γίνονται VB

both are measured by a common measure. For thrice 30 measures 90, and twice <30> 60; and again thrice 8 measures 24, and twice 8, 16. And as 90 is to 60, so 24 is to 16; and as 24 is to 16, so also are the wheels to one another in number and in size, and the base is to the base, as also 3 to 2. The measuring <numbers> then have been shown to mutually have the same ratio proportionally to those being measured. And so the <men> of Apollodorus, in carrying out the construction of his portable towers, will be found not only commensurable but in harmony with <those> of Diades and Charias. And it is clear that the ancient engineers and the very learned master builders carried out the construction of machines scientifically and rationally.

39. When the construction of the tower is thus completed, if the area lying under the base should not be even and level, but happens to slope upward, we shall make a counterplate at the base of the tower with the same intertwined <construction> as it; this comes up against the irregularity of the earth and amplifies the area lying below, so that the tower may be maintained steadfast in position when turbulent battle is joined. It will be guarded against burning from fire-bearing caltrops launched <against it> and from ignited flames if boards are nailed on, especially of palm or others of strong wood, except cedar, fir, and alder, as these easily burn, break, and shatter. Hides should be hung on the tower at the ledges and galleries, which were already mentioned during the construction <account>, not right up against the boards, but a little bit away from them because of the incendiaries and so that the blows of the stone throwers on the hollow space may be weak against these <hides> and dissipated with the slackening of the momentum. The tower should be fitted with nails on top, as was discussed earlier in the case of

λιπαροῦ καὶ κολλώδους ἀναγεμισθῆτω ὁ διὰ μέσου τόπος. Εἰς
 20 δὲ τὰ προκείμενα τοῖς πυροβόλοις μέρη τοῦ πύργου ἀντὶ
 σωλήνων τῶν τὸ ὕδωρ πεμπόντων ἔντερα βοῶν εἰργασμένα
 ὡσὰν τεταριχευμένα παρατίθενται ὕδωρ ἐπιχέοντα. Τούτοις
 τοῖς ἐντέροις ἄσκοι πλήρεις ὕδατος ὑποτίθενται· ἐκθλιβόμενοι
 25 δὲ καὶ πιεζόμενοι ἀναφέρουσι τὸ ὕδωρ. Εἰ δὲ καὶ ἀκρωτήριον
 που τοῦ πύργου δυσδιάβατον καίεται, μὴ ἔστι δὲ ὄργανον ὃ
 καλεῖται σίφων, κάλαμοι τετροπημένοι δι' ὄλου ἔσωθεν οἴους
 οἱ ἰξευταὶ ἔχουσι πρὸς ἀλλήλους συμβάλλονται, καὶ ὅπου δὲ
 ἐκπέμπουσι τὸ ὕδωρ· ἄσκοι γὰρ ὡς καὶ ἐπὶ τῶν ἐντέρων
 30 ὑπόκεινται ἐκφέροντες αὐτὸ διὰ τῶν καλάμων ἐπὶ τὸν
 ἐμπυριζόμενον τόπον. Οὐ μικρὰν δὲ ὠφέλειαν τῷ πύργῳ
 ἐμπαρέξουσι καὶ τύλια ἔξωθεν κρεμάμενα ἀχύροις ὄξει
 βεβρεγμένοις γεμισθέντα, ἢ δίκτυα ἐνύγρων βρύων ἢ τοῦ
 καλουμένου θαλασσοπράσου, ὡς δυνάμενα ἢ μὴ μόνον ταῖς ἐκ
 35 τῶν πυροβόλων ἀντιμάχεσθαι ἐμπρήσεσιν, ἀλλὰ καὶ πρὸς τὰς
 τῶν λιθοβόλων ἀντέχεσθαι πληγὰς. Καὶ δεῖ εἰδέναι ὅτι πᾶσαι
 αἱ ἐκ τῶν πυροφόρων καὶ ἀναπτομένων φλογῶν < . . . > ἢ
 40. < . . . > μέρη τὸν κριὸν βασταζόμενον ἐπιφέρεισθαι. Ἄπο δὲ
 τοῦ τρίτου βαθμοῦ τῆς ἄνωθεν κλίμακος ἐπὶ τὸν τῆς ἐτέρας
 τρίτον καὶ ἰσοῦσῃ διὰ σανίδων στεγάζονται ἢ βεργῶν
 πεπλεγμένων, ἀμφοτέρων δὲ πηλῷ ἐπικεχρισμένων ἢ βύρσαις
 5 βοῶν νεοσφαγῶν σκεπομένων διὰ τε τὰ πυροβόλα καὶ τὰς τῶν
 λίθων βολὰς. Κατωτέρω δὲ τοῦ ἢ τρίτου βαθμοῦ μετὰ πόδας
 δεκαοκτὼ ἢ καὶ εἴκοσι οἱ τυχόντες βαθμοὶ ἄλλην στέγην
 λαμβάνουσιν, οὐ πρὸς ὄλον τὸ πλάτος τῶν βαθμῶν· ἀστεγαστος
 γὰρ ὁ πρὸς τὴν ἀνάβασιν παραλειφθήσεται τόπος. Χρὴ δὲ τὰς
 10 ἐμβαλλομένας περόνας ἐπὶ τοὺς τῶν κλιμάκων μηροὺς πλεόν
 παρεξέρχεσθαι, ἵνα πλατύτερον τῶν κλιμάκων τὸ χωρίον
 στεγάζεται· ἐκεῖ γὰρ ὁ κριὸς ἐνεργήσει μάλιστα ἀπὸ τῆς ἄνωθεν

Wes 248

f. 29

Wes 249

30–35 Οὐ – πληγὰς: Ath. Mech. 18:1–7. 40: 1–44: 45 Ἄπο – ἄλωσιν: cf. Apollod. 185:6–188:9.

25 καίεται Wes: καίηται VB ἢ 26 τετροπημένοι Wes: τετροπημένου VB ἢ 31 κρεμάμενα Wes: κρεμόμενα VB ἢ 36–40: 1 < . . . > Wes (cf. Dain, 30–31) ἢ 9 παραλειφθήσεται Wes: παραληφθήσεται VB

tortoises, and the area between filled with greasy and viscous clay. At the parts of the tower exposed to the incendiaries the intestines of cattle, prepared as it were pickled in brine, are attached for pouring water, as a substitute for water-shooting pipes. Wineskins full of water are attached to these intestines; when squeezed and pressed they dispense the water. And if somewhere a top part of the tower that is hard to reach should happen to be burning, but no so-called siphon device is available, reeds completely hollowed out inside, such as are used by fowlers, are joined to one another and send the water wherever necessary. For wineskins, when they are attached to the intestines, carry it through the reeds to the burning area. Also of no little protection to the towers will be mattresses hung on the outside filled with chaff soaked in vinegar, or nets of marine moss or so-called seaweed, as these are capable not only of counteracting burning from incendiaries, but even of resisting the blows of stone-throwers. You should be aware that all < . . . > from the fire-bearing <cal-trops> and ignited flames < . . . >

40. < . . . > parts (?) the ram in suspension is carried. From the third rung from the top of the ladder to the third <rung> of the other, which is equal in height, the <ladders> are roofed with boards or with plaited branches, and both are smeared with clay or protected with hides of freshly slaughtered cattle against incendiaries or stone shots. Below the third rung, 18 or 20 *podes* down, the rungs there receive another roof, but not over the entire width of the rungs. For the place for climbing upward will be left uncovered. The pins inserted into the sidebars of the ladders must project further out, in order that an area wider than the ladders may be covered. For there the ram will be especially

15 ἡρτημένος στέγης δυσὶ βαστάγμασιν ἰσοῦψέσι παρὰ μικρόν τι, ἵνα καὶ οἱ τὸν κριὸν ὠθούντες ἐπὶ τοῦ καταστρώματος τοῦ ἐστεγασμένου ἐστῶτες χωρίου ἐπὶ τὰ ἀνώτερα μέρη τῶν τειχῶν κριομαχῶσιν· εὐθραυστον γὰρ καὶ εὐκατάλυτον πᾶν τὸ ἀνεστηκὸς καὶ προέχον ὡς ἀπολελυμένον καὶ ἀσύνδετον, οἷαί τέ εἰσιν αἱ ἐπάλλξεις καὶ τὰ προπύργια καὶ ὅσα μὴ πρὸς ἄλληλα συνεχόμενα ἐπιστηρίζονται.

Wes 250

41. Καὶ δι' αὐτοῦ τοῦ κριοῦ τετραγώνου ὄντος δυνήσονται εὐκόλως ἐπὶ τὸ τεῖχος διέρχεσθαι, ὁμοίως τοῖς ἐπὶ τῶν πύργων προειρημένοις (γενομένοις) ἐπὶ τὰ πλάγια περιφραγῶν. Αἱ γὰρ κλίμακες αὐταὶ οὐ περιστραφήσονται ἢ ἐπὶ τοὺς μηροὺς 5 παρατρεπόμεναι, ἀλλὰ μενοῦσιν ἀεὶ ἐφ' ἐστῶσαι καὶ τὰ αὐτὰ συντηροῦσαι πρὸς ἀλλήλας διάχωρα. Καὶ ἡ καταγραφή πρόκειται. ἢ

f. 29v

f. 30

42. (Π)άλιν ἄλλην τάξιν καὶ θέσιν αἱ κλίμακες λαμβάνουσιν τὴν πρὸς τῷ τείχει ἐπερχομένην, ἴσην οὖσαν καὶ παράλληλον ἦτοι ὀρθὴν [κατὰ πρόσωπον], καὶ τὰς μὲν βαθμίδας κατὰ πρόσωπον τοῦ τείχους καὶ ὀπισθεν ἀφορώσας ἔχουσι· τὰ δὲ ἀπ' 5 ἀλλήλων διάχωρα ἄνω τε καὶ κάτω οὐχ ὡς αἱ πρῶται ἄνισα ἔχουσιν, ἀλλ' ἐξ ἴσου τὸ αὐτὸ συντηροῦσι διάστημα. Στέγας δὲ τὰς αὐτὰς τῶν προτέρων ἔχουσι· παραλλάσσουσι δὲ καὶ κατὰ τοῦτο. Ἐντὶ γὰρ τοῦ ἐνὸς κριοῦ τοῦ μεταξὺ τῶν προτέρων δύο κλιμάκων φερομένου δύο ἔξωθεν πρὸς τὰ τῶν μηρῶν πλάγια 10 τιθέμενοι ἐπιφέρονται. Οὗτοι δὲ οἱ κριοὶ κατεργασάμενοί τι ἢ μετακινήσαντες ἢ λύσαντές τι τῶν προκειμένων τῷ τείχει, προσεχάλωντο τὰ ἐκ τῶν ὀπισθεν σχοινία, καὶ ἰὸμοῦ τῷ τείχει αἱ δύο ἐπέρχονται κλίμακες· ἀλλ' ἡ μὲν ἔμπροσθεν ἐπὶ τοὺς βαθμοὺς αὐτῆς προσεγγίζει τῷ τείχει· ἀφίσταται δὲ ἀπ' αὐτῆς 15 ἡ ἑτέρα, ὅσον καὶ τὸ πρὸς ἀλλήλας κατὰ τὴν ἐπίζευξιν ἀπέχει διάχωρον, καὶ γίνεται πρὸς τὸ τεῖχος ἐνεργῆς ἀναβάθρα, καταστρωθεῖσα καὶ περιφραττομένη ἢ ἄνωθεν τῶν κλιμάκων ἐπίζευξις. Καὶ τὸ σχῆμα ὑπόκειται. ἢ

Wes 251

f. 30v

41: 3 προειρημένοις Wes: προειρημένων VB: προσηρτημένων Sch ἢ γενομένων add. Wes ἢ

42: 3 κατὰ πρόσωπον secl. Sch ἢ 12 προσεχάλωντο Sch: προσεχάλωνται V: προσεχάλων B: προσεχάλων Wes

effective, suspended from the upper roof on two suspension <ropes> of not quite equal height, in order that those thrusting the ram, while standing on the deck of the covered area, may use the ram to attack the upper parts of the walls. For everything that stands up and projects forward is easily broken and knocked down, as it is freestanding and unconnected, such as are the battlements and outworks and all things that are not supported by being secured next to one another.

41. And by means of the ram itself, if it is square, they will be able to pass easily to the wall, when there are fences at the sides like those discussed previously on the towers. For the sidebars of these ladders will not rotate tilting sideways, but they will remain always vertical and maintaining the same intervals to one another. And the depiction is set forth.

<fig. 16>

42. The ladders <can> take on yet another arrangement and position, approaching the wall equal and parallel, that is, upright, and they have the rungs <both> facing the wall and facing back; they do not, as the first ones did, have unequal intervals <between them> above and below, but they maintain the same distance equally. They have the same roofs as the earlier ones. But they differ in this: for instead of the one ram carried between the previous two ladders, two rams are held, set on the outer sides of the sidebars. After these rams are in some way effective in either removing or loosening some of the parts lying on the front of the wall, the back ropes are let down and the two ladders go against the wall simultaneously. But the front one approaches the wall with its rungs; the other stands apart from it by as much as the interval between them at the joined area. And the joined area at the top of the ladders, when decked and fenced, is an effective way to climb to the wall. The drawing is below.

Parangelmata Poliorcetica

Title: As noted in the Introduction (2), the rubricator failed to add the notice of author and title in the extensive space left at the head of the first folio of Vat. gr. 1605. A later hand (Dain, *Tradition*, 13, suggests 14th–15th century) has added Ἡρων(ος) (sic) — προοίμ(ιον). Another hand (Devreesse, in a letter to Dain, *ibid.*, 33, suggests Allatius) has added in the upper left corner “1605 Heronis Poliorcetica.” Barocius titles the work “De machinis bellicis,” Martin Πολιορκητικά, Wescher Πολιορκητικά, Schneider Παραγγέλματα Πολιορκητικά. Schneider’s title is now the most frequently cited one.

Chapter 1. Introduction

The Anon. Byz. describes the difficulty of the subject, particularly as the result of the method, both verbal and pictorial, of his sources, lists his major sources, and describes his own method of presentation.

3 **καταγραφῆς:** The term appears in five instances in Apollod. (158:10, 160:2, 170:9, 182:3, and 186:2, four of which are attested in the tenth-century Paris. suppl. gr. 607) at the end of a verbal description and to introduce an accompanying drawing; the Anon. Byz. uses it in a similar manner at **41:6** (drawn from Apollod. 186:2) and also uses the verb (τὸ σχῆμα καταγράφεται) at **44:45**, **49:25** and **51:29**. For the use of the term in the tacticians as “*dessin, tracé*,” see A. Dain, *Histoire du texte d’Élien le Tacticien* (Paris, 1946), 49–51 and 65 n. 1; on its use in the mid-tenth-century *Sylloge tacticorum* to refer to a diagram of an infantry square, see E. McGeer, “The Syntaxis Armatorum Quadrata: A Tenth-Century Tactical Blueprint,” *REB* 50 (1992), 227. See also Mugler, *Dictionnaire*, s.v., and E. M. Bruins, *Codex Constantinopolitanus* (Leiden, 1964), III, 208.

4 **ἀγνωσίᾳ:** The reading, I suggest, is sound, used as in Pseudo-Dionysius, *De mystica theologia* I:1: εἰς τὸν γνόφον τῆς ἀγνωσίας . . . καθ’ ὃν ἀπομυεῖ πάσας τὰς γνωστικὰς ἀντιλήψεις, II:1 δι’ ἀβλεψίας καὶ ἀγνωσίας ἰδεῖν καὶ γνῶναι τὸ ὑπὲρ θεῶν καὶ γνῶσιν. For its function in the Anon. Byz.’s view of the drawings in his source manuscripts, see

the Introduction, 9–10. See also below, **1:39** on σχηματισμός.

5 σχημάτων: The term is that used in Apollod.'s introduction (137:7–8: σχήματα πολλά καὶ ποικίλα διέγραψα) and frequently in his text. On the nature of the original technical illustrations in Apollod.'s text versus those preserved in the extant manuscripts see below, **27:92**. On the Anon. Byz.'s own approach, the σχηματισμός, see the Introduction, 8–14 and below **1:39**. On σχῆμα see also Downey, “Architects,” 116.

7–8 κατασκευὴν καὶ τεκτόνευσιν: Marsden, *Treatises*, 44, suggests that for Heron of Alexandria and Philo Mech. κατασκευή refers to “the complete construction of a piece of artillery from the drawing board to the finished product.” The Anon. Byz.'s use of τεκτόνευσις here may then be pleonastic, as the reversal of the terms below (**1:36**) also suggests, but perhaps also emphasizes the practical nature of his focus.

9 μηχανικῶν: The terms μηχανικός, ἀρχιτέκτων and τεχνίτης are all used by the Anon. Byz. and by Ath. Mech.; Apollod. uses only τεχνίται once and τέκτων once. The Anon. Byz. uses μηχανικοί exclusively of his classical sources or other ancient “engineers.” His use of ἀρχιτέκτονες is often similar in time frame (cf. **2:14–15** κατὰ τοὺς πάλαι ἀρχιτέκτονας), although he also describes them as πολυμαθέστατοι (**38:22**) and μαθηματικοί (**50:30**, where they are also said to be able to alter the dimensions of a siege device in terms of local topography), adjectives not found in his sources. Whether these descriptions apply only to the ἀρχιτέκτονες “of old” or reflect a contemporary perspective on their level of education is uncertain. He does use πολυμαθέστατος again in the *Geodesia* (**1:15**) of his ancient sources for that treatise. The uses of ἀρχιτέκτων at *De cer.* 701:4 and Anna Comnena, *Alexiad* III:4:3 suggest the the term was used in the middle Byzantine period of individuals with significant education. Downey, “Architects,” 109, suggests that μηχανικός was by the time of Procopius the term used for highly skilled individuals with both theoretical education as well as practical skills, and superior to the ἀρχιτέκτων, who was a “chief of carpenters or builders.” C. Mango, *Byzantine Architecture* (New York, 1974), 24, argues that while μηχανικός is usually translated as “engineer,” he was more properly “an architect having a grounding in mathematics.” He further suggests “We may imagine that, as time went on, the *architektones* sank to

the level of the craftsman.” The Anon. Byz. also says (26:6, 29:12) that the τεχνίτης is capable of altering the dimensions of siege engines to the requirements of local topography, passages perhaps influenced by Ath. Mech. (19:1–2: Ἄλλὰ τοιαῦτα μηχανήματα ἔξεστι μετασκευάζειν τῷ τεχνίτῃ ἐμβλέποντι εἰς τοὺς τόπους τῶν προσαγωγῶν). The reliance on classical sources makes isolation of contemporary usage difficult. I have used “engineer,” “master builder,” and “craftsman” respectively in the translation.

10 Ἀπολλοδώρου: Apollodorus of Damascus, the chief engineer in Trajan’s Dacian Wars and architect of the famous bridge over the Danube, banished and executed by Hadrian. For editions and translations of his *Poliorcetica* see the Bibliography. For a recent view that some two-thirds of the text of the *Poliorcetica* attributed to him are later additions, particularly those portions describing impractical devices, and that the remaining third was not written by Apollod. himself, see Blyth, “Apollodorus,” *passim*.

10 Ἀδριανόν: The text of Apollod. is presented as a response to a letter of request received from an unnamed emperor, addressed only as δεσπότης. It has been argued (T. Reinach, “A qui sont dédiées les Poliorcétiques d’Apollodore?” *Revue des études grecques* 8 [1895], 198–202; R. T. Ridley, “The Fate of an Architect: Apollodorus of Damascus,” *Athenaeum* 67 [1989], 551–65, specifically 560, and Blyth, “Apollodorus,” 149–53) and seems quite likely that this δεσπότης was Trajan, not Hadrian. The basis on which the Anon. Byz. has opted for Hadrian is unknown. For an example of apparent corruption of Τραιανέ to Ἀδριανέ in the dedication of Aelian’s *Tactica*, see A. Dain, *Histoire du texte d’Élien le Tacticien* (Paris, 1946), 19 and n. 1.

11 Ἀθηναίου: His date is not certain, but probably 1st century B.C. and a contemporary of Vitruvius, chapters of whose 10th book on military engines are quite similar to sections of Ath. Mech. (see Marsden, *Treatises*, 4–5 with references to opposing views). For editions and translations of his *Περὶ μηχανημάτων* see the Bibliography.

12 Μάρκελλον: Most likely C. Claudius Marcellus, Augustus’ nephew and son-in-law, who died in 23 B.C. (see Marsden, *Treatises*, 5).

12 Ἀγησιστράτου: Dated by Marsden, *Development*, 206 with discussion of other views, to the second quarter of the first century B.C. On the use of Agesistratus' work by Ath. Mech. and Vitruvius see Marsden, *Treatises*, 4–5. The Anon. Byz.'s mention here of the use by Ath. Mech. of Agesistratus and below by Biton of different earlier engineers may be intended to set his own use of the classical sources in the tradition of poliorcetic writing.

13 ὑπομνήματα: The title of Ath. Mech.'s work is Περὶ μηχανημάτων (Schneider, *Athenaios*, 8; Marsden, *Treatises*, 4).

13 Βίτωνος: His work, titled Κατασκευαὶ πολεμικῶν ὀργάνων καὶ καταπαλιτικῶν (Marsden, *Treatises*, 12, 66), is dated by Marsden, *Treatises*, 6, 78 n. 1, with a discussion of other views, to ca. 240 B.C. See also M.J.T. Lewis, "When was Biton?" *Mnemosyne* 7 (1999), 159–68, who suggests 156 or 155 B.C. For text, translation, and commentary see Marsden, *Treatises*, 61–103. Biton is cited again below by name at 54:10.

13 Ἄτταλον: Marsden, *Treatises*, 6, 78 n. 1 suggests Attalus I of Pergamum, based on his dating of Biton; but for other views see Garlan, *Recherches*, 167 n. 8, and M.J.T. Lewis (as in previous note).

15 < . . . >: Wescher in his note (198 n. 7), followed by Schneider in both text and note (5 n. 2: "offenbar verstümmelt"), posited a lacuna here, based on the absence of references to Heron of Alexandria and Philo Mech. whose works are cited subsequently. Wescher in his note suggests reading: . . . μηχανικῶν· (τὰ Ἡρώου Ἀλεξανδρέως) βελοποιϊκά, καὶ τὰ (Φίλωνος) πρὸς Βελοποιϊκά is attested in titles of works by Heron and Philo Mech. (Marsden, *Treatises*, 18, 106), and is used below (45:23) specifically in reference to that of Heron. Philo Mech.'s overall work is titled Μηχανικὴ σύνταξις, which was originally arranged in nine books of which the fourth was titled βελοποιϊκά and the eighth πολιορκητικά (see Marsden, *Treatises*, 156). The Anon. Byz. most frequently cites from the latter. On the formation of a "corpus" of classical poliorcetic authors, as seen in Paris. suppl. gr. 607 (dated late 9th–early 10th century by Wescher, ca. 925–950 by Dain, later by Müller; see also Marsden, *Treatises*, 11–12), and consisting of the works of Ath. Mech., Biton, Apollod., and Heron of Alexandria (*Bel.*, *Cheiroballistra*, *Dioptra*) and in other versions Philo Mech., see Dain, "Stratégistes," 379–81.

17 **διαιτητικά**: Cf. below, **3:49–51** on dietary preparations for cities under siege, διὰ . . . βρώσεως . . . καὶ . . . διαίτης and the related scholion on the “epimonidian” compound, derived from Philo Mech. On the husbanding and distribution of foodstuffs while under siege, cf. *De obsid.* 48:12ff.

19 **τεχνολογίαν**: For τεχνολογεῖν, “to prescribe the rules of an art,” see Aristotle, *Rhetorica* 1354b17 and on τεχνολογία as “technical treatise” see D. A. Russell, *Longinus’ On the Sublime* (Oxford, 1964), 60 n. on 1:1. The Anon. Byz. here uses it not of a treatise, but of the system used in such treatises, on which see Basil, *Adversus Eunomium libri tres* I:9 (PG 29:532C): Οὗτε γὰρ ἴσμεν τεχνολογίας λέξεων and Iamblichus, *De vita Pythagorica* 182: εἶναι δὲ τὸν καιρὸν μέχρι μὲν τινος διδασκόν τε καὶ ἀπαράλογον καὶ τεχνολογίαν ἐπιδεχόμενον; see also George the Monk, *Chronicon*, ed. C. de Boor, 2 vols. (Leipzig, 1904; repr. Stuttgart, 1978, with corrections by P. Wirth), 1:13. Martin renders “la méthode d’exposition générale,” Schneider “nach der . . . üblichen Ausdruckweise.”

21–22 **ἀσυνήθη . . . ὀνόματα**: The wording is taken directly from the preface of Apollod. (138:14–15). Nevertheless, it is a consistent part of the Anon. Byz.’s method to simplify vocabulary (see the Introduction, 5–8).

22 **βίβλφ**: See on **δέλτωφ** at **2:21**.

25–28 **Μόνα . . . παραθέμενοι**: The Anon. Byz. indicates that he has gathered his added material “from the remaining <writers>” and he uses, in addition to Apollod., Ath. Mech., Heron, and Philo Mech. extensively and Biton more sparingly in the text. However, he also adds clearly contemporary material, for example, the tortoise called *laisa* (see below on **2:4**) as well as material not found in extant classical sources (e.g., the wheeled ladder described in chap. 46), which may or may not be contemporary. See Dain, *Tradition*, 16 n. 2, for a list of new or otherwise unattested items. The sentence lacks a main verb.

26–27 **ἐπεργασιῶν . . . ἐπενθυμημάτων**: The terms (see ἐπενθυμημάτων repeated below at **3:7** with ταυτολογιῶν and ἐπαναλήψεων) may reflect an acquaintance, direct or more likely through handbooks, with the rhetorical system found in the Hermogenic *On Invention*, in which ἐργασία (“a working out”) is a supporting statement to an epicheireme,

the enthymeme and epenthymeme supporting statements and additional supporting statements to an *ergasia*. See *Hermogenis Opera*, ed. H. Rabe (Leipzig, 1913), 148–52, and G. Kennedy, *Greek Rhetoric under the Christian Emperors* (Princeton, N. J., 1983), 90–91. Ἐπεργασία is not found in Hermogenes, but it is attested as a rhetorical term at Porphyry, *ad Iliadem* 17:608:6: ἀλλὰ δεῖ νοεῖν τὰ μὲν διὰ μέσου εἰρημένα, τὰ δὲ κεφαλαιωδῶς ἐξενηνεγμένα ὕστερον τῆς ἐπὶ μέρους ἐπεργασίας τυχόντα κατ’ ἐπανάληψιν, notably with ἐπανάληψις, on which see below, **3:6**, and at *Scholia ad Iliadem* 13:203: θαυμαστῶς (δὲ) τῇ ἐπεργασίᾳ ἐχρήσατο ὁ ποιητὴς εἰπὼν “κεφαλὴν κόψεν.” On the Anon. Byz.’s method of verbal description see the Introduction, 5–8).

30 κοινῆς ἐννοίας ἀξιώματα: Proclus, in explaining the term “axiom” (*In primum Euclidis librum commentarius* 194:9), comments: τὰτὸν γὰρ ἐστὶν κατὰ τούτους (i.e., Aristotle and the γεωμέτραι) ἀξίωμα καὶ ἔννοια κοινή. For a discussion of “axioms or common notions,” see Heath, *Elements*, 221–22, and Mugler, *Dictionnaire*, at ἀξίωμα. I do not find the specific formulation here attributed to Anthemius elsewhere.

31 Ἀνθέμιον: Anthemius of Tralles, the “chief expert” connected with the building of St. Sophia, called by Procopius (*De aedificiis* I:1:50) and Agathias (V:8) μηχανοποιός. See *ODB* I:109.

33 ιδιωτεία λέξεων: Cf. below, **3:3** τὸ ιδιωτικόν and *Geodesia* **1:26** τὸ ιδιωτικώτερον.

34 ἀπλότητι λόγου: As a stylistic term cf. Dionysius Halicarnassensis, *Ars Rhetorica* 9:14:5: τὰς ἀπλότητας τῶν κοινῶν λόγων.

35 παρὰ . . . τυχόντων: From Apollod. 137:10; cf. below, **2:16–17** ὑπὸ τυχόντων τεχνιτῶν.

39 σχηματισμὸς καλῶς διορισθείς: The Anon. Byz. here appears to distinguish by terminology (σχηματισμὸς vs. σχῆμα, the former term not found in his classical predecessors) his own approach to illustration from that which he finds in his sources and which he judges inadequate for practical construction. See the Introduction, 10–11.

40 δύσφραστον: Cf. Ath. Mech., 39:7–10: Διόπερ, ἐὰν κρίνης, ἐσχηματογραφημένα πάντα ἔσται τὰ μηχανήματα· καὶ τὸ ἐν τῇ λέξει δύσφραστον ἐπ’ αὐτῶν εὐδηλον ἔσται.

Chapter 2. Table of Contents

This “table of contents” is modeled on that in Apollod. (138:18–139:8), with adjustments for the Anon. Byz.’s additions from other sources as well as contemporary material.

1 **χελωνῶν**: χελώνη = Latin *testudo*. For the first attested Greek use in sieges see Xenophon, *Hellenica* III.1.7 (χελώνη ξυλίνη) on the undermining of the wall of Larisa in 399 B.C. For its debated fifth-century origins see Whitehead, *Aineias*, 196, and generally *RE* III:2229–30.

2 **ὄρυκτριδῶν**: The χελώνη ὄρυκτρίς, a shelter for sappers undermining a wall or tunneling, is described by the Anon. Byz. at chaps. 13–15, drawing on Apollod. 143:6–147:6, who calls them διορυκτριδεις. See also Ath. Mech. 19:3–20:3, Vitruvius X:15:1 (with the note by Callebat and Fleury, *Vitruve, ad loc.*), and Garlan, *Recherches*, 351. See also below **13:5**; it is illustrated on folios 11r and 12v.

2 **χωστρίδων**: The χελώνη χωστρίς, a shelter for men leveling terrain and filling ditches, thus preparing the way for the advance of siege towers and giving access to the walls. The Anon. Byz. briefly discusses its shape at chap. 11, following Philo Mech. 99:41–44. See also Ath. Mech. 15:13–19:2, Vitruvius X:14 (with the extensive note by Callebat and Fleury, *Vitruve*, 254ff), Lendle, *Schildkröten*, 6–29, and Garlan, *Recherches*, 234–36. The tortoise is illustrated on folio 8r.

3 **κριοφόρων**: The Anon. Byz. describes the ram-carrying tortoise at chaps. 22–24, following Apollod. 153:8–156:2, and that of Hegetor, the largest in antiquity, in chaps. 25–26, following Ath. Mech. 21:1–25:2. See also Philo Mech. 99:44 and Lendle, *Schildkröten*, 103–21. The device is illustrated on folios 18r and 20r.

3 **προτρόχων**: The term is found elsewhere only at Ath. Mech. (34:1, 7), used as a substantive to refer to a wheel he recommends placing on any tortoise to permit changes of direction (on which see Lendle, *Schildkröten*, 87ff). The term here, if the reading is correct, would appear to refer to a separate type of tortoise. Martin (449 n. 3), noting its absence in Apollod.’s list and use by Ath. Mech., comments “Héron le Jeune désigne ici, par l’adjectif πρότροχος, la tortue qui a ainsi une roue

de devant”; Schneider, printing προτρόχων, comments in his apparatus, “man erwartet ύποτρόχων” and translates “und auf Räder gesetzt” relating it to the ram-tortoise. As the term πρότροχος does not appear elsewhere in the Anon. Byz. and the ram-tortoise is described as τετράτροχος, Schneider’s suggestion may be correct.

4 λαισῶν: This device, as the νῦν . . . ἐφευρεθεισῶν indicates, is a contemporary Byzantine tortoise. The Anon. Byz. describes them below at chaps. **9** and **11** and refers to them in chaps. **17** and **47**. See below, chap. **9**.

5 ἐμβόλων: In Apollod.’s list they are initially called simply χελωνῶν πρὸς τὰ κυλλόμενα βάρη, later (140:9–10) ἡ δὲ χελώνη ἐμβόλου σχήμα ἔχουσα. The Anon. Byz. describes them in chap. 7.

5 γεροχελωνῶν: Wicker tortoises are described by the Anon. Byz. in chap. 8, derived from Philo Mech. 99:29–36, and illustrated on folio 7v.

5 τριβόλων: Tripod barriers (not the smaller anticavalry “caltrops” on which see below, **11**:19) for use against heavy objects rolled down against besiegers from cities on hills. The Anon. Byz. describes them in chap. 6, following Ath. Mech. 38:2–9. They are illustrated on folio 7v.

6 κριῶν: The Anon. Byz. briefly comments on composite and single-beam battering rams in chap. 21, drawing on Apollod. 159:2–161:8 and in chaps. 25–26, drawing on Ath. Mech. 23:11–26:4. See Lendle, *Schildkröten*, 49–86.

6 ξυλοπυργίων φορητῶν: The Anon. Byz. describes “portable towers” in chaps. 30–39, drawing on Apollod. (164:10–167:9, 173:9–174:7) and Ath. Mech. (10:8–12:11 and 17:14–18:7), with some material lost (on the lacuna see Dain, *Tradition*, 28–31). The illustration appears on folio 26r. Both sources use πύργοι. Ath. Mech. adds the adjective φορητός, on which see Winter, *Fortifications*, 320–21, Callebat and Fleury, *Vitruve*, 243 and Fleury, *Mécanique*, 290. Below the Anon. Byz. uses ξυλίνους πύργους (**30**:4) and φορητῶν πυργῶν (**38**:20). For the compound ξυλόπυργος see, for example, *Miracula Demetrii* 188:31, *De œr.* 670:10–11, and Anna Comnena, *Alexiad* XIII:3:12. For discussion of the devices see Lendle, *Texte*, 71–106.

7 κλιμάκων: An inflatable hide ladder (drawn from Philo Mech. 102:12–19) is described in chap. 12 and illustrated on folio 9v. A large section of the discussion of ladders, drawing on Apollod. 175:1ff, is lost (on the lacuna see Dain, *Tradition*, 28–31); chapters 40–43 describe ladders used to support rams, drawing on Apollod. 185:7–188:9, illustrated on folios 29v and 30v. Chapter 46 describes a ladder with wheels at the bottom and a “drop-bridge” on top that is not found in any extant source and may be a Byzantine innovation (see Dain, *Tradition*, 16 n. 2). For a discussion of ladder systems in Apollod. see Lendle, *Texte*, 1–35.

7–8 εἶδη διάφορα: On the shift from the genitives dependent on χρεία ἐστὶ to the nominatives, an anacoluthon even more pronounced in Apollod., see Martin 450 n. 1 and Blyth, “Apollodorus,” 134 and 157–58.

8–9 προφυλακὴ . . . βάρη: The Anon. Byz. describes in chap. 22 a ram tortoise with a projecting front roof (22:48ff) to defend against μέγιστοι λίθοι and πλάγια ξύλα dropped against the ram. For use of projecting beams (κεραῖαι λιθοφόροι) to lift and drop large stones on besiegers, see Marsden, *Treatises*, 51. The *locus classicus* is Archimedes’ defense of Syracuse (Polybius, VIII:5: ὄργανα . . . προπίπτοντα πολὺ τῆς ἐπάλλξεως ταῖς κεραῖαις· ὧν τινὰ μὲν ἐβάσταζε λίθους οὐκ ἐλάττους δέκα ταλάντων . . . τότε περιηγόμενοι καρχησίῳ πρὸς τὸ δέον αἱ κεραῖαι διὰ τινος σχαστηρίας ἠφίεσαν εἰς τὸ κατασκεύασμα τὸν λίθον). See also the (Περὶ Στρατηγίας) 13:121–35 and the *De obsid.* 48:4–5, 74:9–11, 82:6–7.

9 τὰ . . . ἀναπτόμενα: Protection of portable towers against fire is described at the end of chap. 39, drawing on Apollod. (174:1–7) and Ath. Mech. (18:1–7). The phrase ἀναπτομένων φλογῶν, which is not found in the Anon. Byz.’s known sources, occurs below at 15:16, 39:9 and 36; the precise nature of the incendiary in each instance is not always clear. See below on πυροβόλος 2:9. For ἀνάπτω see Trapp, *Lexikon*, s.v.: “(intr.) Feuer fangen, aufflammen, (ent)brennen.”

9 πυροβόλων: The term is used eight times in the text, including at 14:15, where it refers to “dry wood shavings spread with liquid pitch or smeared with oil” and at 49:20 where it refers to the handheld swivel tube for ejecting “Greek fire” (μετὰ στρεπτῶν ἐγχειριδίων πυροβόλων); this second verbal description is further clarified by the illustration on

folio 36r. The Anon. Byz. also uses for incendiaries πυροφόρος (e.g., alone as a substantive at **50**:28 and as an adjective with τρίβολος at **39**:8) and αἱ ἀναπτόμεναι φλόγες (see on τὰ . . . ἀναπτόμενα **2**:9). See commentary on **39**:8 and **49**:20, and generally on pre-gunpowder incendiaries Partington, *History*, 1–21, and A. R. Hall, “A Note on Military Pyrotechnics,” in Singer et al., *Technology*, II:374–82.

9 **σκοποί**: These scout-ladders (Lendle, *Texte*, 28 “Spähleiter”) are described in chaps. 27–29, drawing on Apollod. (161:9–164:4). For discussion see Lendle, *Texte*, 28–35. They are illustrated on folios 22v and 23r.

10 **διορυγαὶ** . . . **διάφοροι**: various methods of excavating through walls are described in chaps. 13–20.

11 **διαβάθραι** . . . **εὐμήχανοι**: Drop-bridges attached to filler-tortoises specifically for use over ditches are described in chap. 47 and illustrated on folio 35r; other similar bridges for use on folding ladders for reaching the top of a wall are described in chaps. 46 and 49, illustrated on folios 34r and 36r. The invention of the drop-bridge is attributed (following Ath. Mech.) to Diades in chap. 30. The Anon. Byz. uses both ἐπιβάθρα and διαβάθρα for the device; for a third alternative see the drop-bridges on a portable tower in Anna Comnena, *Alexiad* XIII:3:9 (Bohemund’s siege at Dyrrachium): Πόργος ξύλινος κατεσκευάστο . . . Ἔδει γὰρ οὕτως κατεσκευάσθαι τὸν μόσυνα τοῦτον, ἵνα διὰ τινων ὑποβαθρῶν μετεώρων πρὸς τὸ χθαμαλότερον καταχαλωμένων τὸ τεῖχος τῆς πόλεως ἐκεῖθεν εὐκόλως καταδραμεῖται. For discussion of the device see Lendle, *Texte*, 88–91; Garlan, *Recherches*, 163 and 227–28; Callebat and Fleury, *Vitruve*, 253 n. 8.3; and notes on the chapters cited.

11–12 **δίχα κλιμάκων** . . . **ἐπιβαίνουσαι**: Chapters 50–52 describe tube-like structures mounted on both wagons and tortoises; they are illustrated on folios 38r and 38v. For discussion see Lendle, *Texte*, 107–16, and Marsden, *Treatises*, 90–94.

12–13 **πολιορκητήρια** . . . **ἀπαράπτωτα**: See **53**:36 where the latter adjective is repeated and generally chap. 53, where the Anon. Byz. draws on Ath. Mech. (32:3–33:3) to describe the πιθήκιον, a weight for maintaining the stability of ships joined together to support raised gangways

for attacks on coastal city walls; illustrated on folio 40r. For discussion see Lendle, *Texte*, 156–60.

14 **διαβάσεις**: Chapters 55–57, drawing on Apollod. (189:1–193:5), describe the use of rafts for river crossings; they are illustrated on folios 41r and 42r. For discussion see Lendle, *Texte*, 177–83.

15 **ἀρχιτέκτονας**: See above on **1:9**. For a view of the content of military “architecture,” see Leo, *Taktika*, Epilogus, 59–60.

15–19 **εὐπόριστα τῆ ὕλη . . . εὐδιάλυτα**: The list of desirable characteristics is modeled on Apollod., omitting his **δύσκαυστα** and **δύστρωτα**, using **εὐδιάλυτα** for **εὔλυτα**, and adding **εὐσύνθετα** (which is found at Apollod. 155:16) **πρὸς τὴν χρείαν**. Cf. Heron, *Bel.* 90: **Γίνεται δὲ τὰ πλεῖστα μέρη τοῦ παντὸς ὀργάνου ἀφαιρετά, ὅπως, ἐὰν δέη μεταφέρεσθαι τὸ ὄργανον, λύσαντες αὐτὸ εὐκόπως μεταφέρωσιν**. See also below on **22:63–64**.

16–17 **ὑπὸ τυχόντων τεχνιτῶν**: See above on **1:9**. For a tenth-century Byzantine example, cf. Leo diac. (16:21) **καὶ τὰς ἐλεπόλεις ἐκλογῆ τεχνιτῶν ἐτεκταίνετο**, of Nikephoros Phokas preparing for the siege of Chandax.

20–21 **στρατηγικὴν ἐπιστήμην . . . ἐφοδιάζειν**: The phrase is repeated at *Geodesia* **1:20–21** and in the scholion at **6:13**. Cf. Leo, *Taktika* **1:3**: **Στρατηγικὴ (τέχνη) δὲ ἐστὶν στρατηγῶν ἀγαθῶν συνάσκησις ἧγουν μελέτη καὶ γυμνασία μετὰ στρατηγημάτων ἥτοι τροπαίων συναθροισμοῦ**.

21 **ἐφοδιάζειν**: Cf. Apollod. 137:10–138:1 **Ταῦτά σοι ἐφωδίασα, δέσποτα . . .** and below **45:2**, and *Geodesia* **1:21** and in the scholion at **6:13**.

21 **δέλτωφ**: On the use of the term for “codex” and its relation to βίβλος, see Atsalos, *Terminologie*, 106ff.

Chapter 3. Stylistic Issues

The Anon. Byz. combines here his own observations on style and general subject matter with cited material from Porphyry (*Vita Plotini*) and Plato, and with uncited material from Ath. Mech., Heron of Alexandria, and Philo Mech.

1 ἐξονυχιστής: For the noun see Demetrakos, *Lexikon*, and Koumanoudes, *Synagoge*, s.v; Souda, Epsilon 1802 defines the verb: ἐξετάζειν τοῖς ὄνυξι. As literary criticism cf. Synesius, *Dion* 267:18, βιβλίον ἐξονυχίζειν and Julian, *Orationes* 7:216a: οὐδὲν θαυμαστόν ἄνδρα στρατιώτην μὴ λίαν ἐξακριβοῦν μηδ' ἐξονυχίζειν τὰ τοιαῦτα (i.e., philosophical problems).

1 ἀττικίζουσαν: On Atticism in the tenth century see R. Browning, “The Language of Byzantine Literature,” in S. Vryonis, ed., *The “Past” in Medieval and Modern Greek Culture* (Malibu, Calif., 1978), 103–34, repr. in R. Browning, *History, Language and Literacy in the Byzantine World* (Northampton, 1989), XV, esp. 117–19, and Kustas, *Rhetoric*, 64–66.

2–3 δεινότητα . . . εὐρυθμίαν: The list is due to the Anon. Byz. Δεινότης and κάλλος are among Hermogenes’ seven qualities of style in the *De ideis*, the former the cornerstone of the system and a component of Attic style (see Kustas, *Rhetoric*, 65).

3 ἰδιωτικὸν . . . ὕπιον: On the former term for “ordinary” as opposed to “professional” style, cf. Aristotle, *Poetica* 1458a21, and “Longinus,” *Περὶ ὕψους* 31.2 with the comments of D. W. Lucas, *Aristotle, Poetics* (Oxford, 1968), 208. On the latter as “flatness of style” see Hermogenes, *De ideis* 2:1:6, 2:4:14, and 2:11:60.

4 τῶν πάλαι σοφῶν: Apparently Ath. Mech., who is quoted in what follows.

6–7 ταυτολογιῶν καὶ ἐπαναλήψεων καὶ ἐπενθυμημάτων: The Anon. Byz. has added these terms to the recommendations for clarity and conciseness (σαφηνείας . . . συντομίας) given by Ath. Mech. On the Anon. Byz.’s method see the Introduction, 5–8. On the difficult relation between repetition and clarity see Kustas, *Rhetoric*, 70 and 94; on ἐπανάληψις, see *Hermogenis Opera*, ed. H. Rabe (Leipzig, 1913), pp. 423ff; for ἐπενθυμήματα see above on 1:26–27.

8–9 διαλεκτικῶν . . . ἀνοίκειος: For Ath. Mech.’s τῶν δὲ ῥητορικῶν παραγγελμάτων οὐκ οἰκείος εἶναι, the Anon. Byz. changing Ath. Mech.’s ῥητορικῶν to διαλεκτικῶν and adding the second phrase, perhaps, as Barocius suggested (*ad loc.*), reflecting Aristotle, *Rhetorica* I:1: Ἡ ῥητορική ἐστιν ἀντίστροφος τῇ διαλεκτικῇ.

13 καὶ τῶν πραγμάτων: The phrase is not in the passage of the *Vita Plotini* and is apparently added here by the pragmatically oriented Anon. Byz. to mark the contrast between “concept” and “thing.” For the opposite perspective, passages extolling a knowledge of calligraphy, grammar, and orthography, see N. Oikonomides, “Mount Athos: Levels of Literacy,” *DOP* 42 (1988), 167–78, esp. 170–71.

13–14 Τριττὰ . . . πράγματα: The phrasing is not found specifically in Porphyry or Plotinus, but is found in the sixth-century Neoplatonists on the controversy over the subject of Aristotle’s *Categories*. See, for example, Olymp. Phil., *Proll.* 18:25–27: οὐ μία τοίνυν γέγονε δόξα περὶ τοῦ σκοποῦ τῶν Κατηγοριῶν, ἀλλὰ τοσαῦτα γέγονασιν δόξαι, ὅσα τὰ ὄντα καθέστηκε· τριττὰ δὲ ταῦτα, ἢ πράγματα ἢ νοήματα ἢ φωναί, καὶ τὰ μὲν πράγματα θεόθεν παράγεται, τὰ δὲ νοήματα ὑπὸ τοῦ νοῦ, αἱ δὲ φωναὶ ὑπὸ τῆς ψυχῆς· εἰς τοσαῦτα τοίνυν καὶ ὁ σκοπὸς μερίζεται. Τῶν (δὲ) διαφόρων αἰρέσεων τοῦτον μερίζουσῶν τρεῖς γέγονασιν αἰρέσεις περὶ τοῦ σκοποῦ, καὶ ἡ μὲν ἔλεγεν περὶ φωνῶν μόνων διαλέγεσθαι τὸν Ἀριστοτέλη, εἰς ἣν ἦν ὁ Πορφύριος, ἡ δὲ περὶ μόνων πραγμάτων, εἰς ἣν ἦν ὁ Ἐρμῖνος, ἡ δὲ περὶ μόνων νοημάτων, εἰς ἣν ἦν Ἀλέξανδρος; and Elias Phil., *In Cat.* 129:9–11: τριττὰ δὲ τὰ ὄντα, φωναί, νοήματα καὶ πράγματα. Οἱ μὲν οὖν περὶ φωνῶν εἰρήκασιν τὸν σκοπόν, ὡς Ἀλέξανδρος καὶ Εὐστάθιος, οἱ δὲ περὶ νοημάτων, ὡς Πορφύριος, οἱ δὲ περὶ πραγμάτων, ὡς Ἐρμῖνος.

19–20 τὴν κατὰ διάθεσιν . . . ἄγνοιαν . . . διπλῆν: The closest statements in Plato are at *Sophist* 229bc: Τὴν ἄγνοιαν ἰδόντες εἴ πη κατὰ μέσον αὐτῆς τομὴν ἔχει τινά· διπλῆ γὰρ αὐτὴ γινομένη . . . Τὸ μὴ κατειδότα τι δοκεῖν εἰδέναι, and *Charmides* 166d: φοβούμενος μὴ ποτε λάθω οἰόμενος μὲν τι εἰδέναι, εἰδὼς δὲ μὴ, but Plato does not use the phrase κατὰ διάθεσιν in this context. It is, however, widely used in discussions of the “double ignorance” by John Philoponos, for example, *In Aristotelis Analytica Posteriora commentaria* 13(3):191:20–25: Κατὰ διάθεσιν δὲ αὐτὴ, ὅτι διάκειται πῶς κατ’ αὐτὴν ὁ ἔχων καὶ οἶεται εἰδέναι ἠπατημένως· διὸ καὶ διπλῆ καλεῖται ἡ τοιαύτη ἄγνοια· οὐδὲ γὰρ οἶδεν ὅτι οὐκ οἶδεν, ἀλλὰ μὴ εἰδὼς καὶ αὐτὸ τοῦτο ἀγνοεῖ, ὅτι ἀγνοεῖ· αὕτη οὖν ἡ κατὰ διάθεσιν ἄγνοια) and cf. Aristotle, *Analytica Posteriora* I:16: “Ἀγνοια δ’ ἢ μὴ κατ’ ἀπόφασιν ἀλλὰ κατὰ διάθεσιν λεγομένη ἔστι μὲν ἡ διὰ συλλογισμοῦ γινομένη ἀπάτη, suggesting that the Anon. Byz. has derived the concept from an intermediate source. Curiously similar phrasing is also

found in G. Pachymeres, *Paraphrase of Pseudo-Dionysius* (PG 3:1020A): οἴονται τῇ ἑαυτῶν γνώσει τὸ θεῖον εἰδέναι, νοσοῦντες τὴν διπλὴν ἄγνοιαν, δηλονότι τὴν κατὰ διάθεσιν, καὶ τὰ θεῖα ἀγνοοῦντες, καὶ ὅτι ἀγνοοῦσιν οὐκ εἰδότες. Martin (*ad loc.*) argued that the Anon. Byz. misunderstood Plato, because of his use of εἰδέναι instead of οἶεσθαι or similar verb for “supposing” rather than “knowing”; Schneider (*ad loc.*) suggested that there is a corruption of the text. I have retained the reading of the archetype as an apparent error on the part of the Anon. Byz.

22–24 ὁ ἱστοριογράφος Καλλισθένης . . . θεῖναι: From Ath. Mech. 7:1–4; for Kallisthenes, Aristotle’s grandnephew, who accompanied Alexander as “recorder of deeds” see F. Jacoby, *Die Fragmente der griechische Historiker* (Berlin, 1923; repr. Leiden, 1957), no. 124. For the Byzantine position on the relation of person, style, and subject matter, see Kustas, *Rhetoric*, 145.

26–27 Φιλολάου . . . Ἀπολλωνίου: The list replaces one in Ath. Mech. which reads: Straton, Hestaios, Archytas, and Aristotle. Schneider, *Athenaios*, 53, suggests that the changes are due to the Anon. Byz.’s ignorance of the first three (who are connected with works on mechanics). Martin (260) notes, however, that the Anon. Byz. employs the list in relation to Kallisthenes’ dictum on the relation of style and subject, while Ath. Mech. employs his relative to the Delphic dictum to be sparing of time. The changes, then, may relate to this different point of comparison.

Presumably the Anon. Byz. is citing authors whose approach to their subjects is more academic and abstract than he considers appropriate in a treatise on poliorcetics. Martin plausibly conjectures that Aristotle and Isocrates are cited as sources of rhetorical theory, Aristophanes (of Byzantium) and Apollonios (Dyskolos) as grammarians. His suggestion that the Anon. Byz. has confused Philolaus with Philodemus who wrote on rhetoric seems unnecessary. At *Geodesia* Chap. 8 the Anon. Byz. cites Pythagorean views of the cube which may be traced to Philolaus and he is perhaps cited here, following references to Plotinus, Porphyry and Plato, as an example of a more philosophical approach than the Anon. Byz. intends to employ. Philolaus is also cited a number of times by Proclus in the *In primum Euclidis librum commentarius*.

32 **μαθηματικός**: The characterization is that of the Anon. Byz.

32–33 **τὸ Δελφικὸν . . . φείδεσθαι**: The dictum is cited from Ath. Mech. 3:4–5; attribution of knowledge of it to Heron and the combination with the following comment are due to the Anon. Byz.

33–34 **τὰ τοῦ καιροῦ . . . σοφίας**: From Ath. Mech. 4:12–13, where it is said to be τῶν ἀρχαίων φιλοσόφων. For its likely source, Anaxarchus of Abdera (4th century B.C.), see Schneider, *Athenaios*, 52–52.

34–42 **τὸ μέγιστον . . . ἐνστάντος**: The section is taken with minor variations from Heron, *Bel.* 71–72. Marsden, *Treatises*, 44, notes on ἀταραξία that the theme of “si vis pacem, para bellum” (or “para machinas”) was an ancient commonplace. Cf., for another view, the comment of Theo. Sim. 1:4:1: τὴν πόλιν ἐξαπιναιῶς ἄφρακτον οὖσαν ἐλάμβανε πολεμικῶν τε ὀργάνων χηρεύουσαν διὰ τὸ ἐκ τῆς εἰρήνης ῥαθυμίαν πολλὴν ὑπερεκχεῖσθαι τῆς Θράκης· ἀφύλακτον γὰρ εἰρήνη καὶ προμηθείας οὐκ ἀνεχόμενον.

44 **ὀλιγαρκέσιν**: The characterization here and below is that of the Anon. Byz.

44 **ἐπιμονιδίσις**: This spelling, which is that of Vat. gr. 1605 as well as the manuscripts of the Anon. Byz.’s source text Philo Mech., is retained by Wescher and Schneider, changed (to ἐπιμενιδίσις) by Barocius, Martin, and Garlan, *Recherches*. Garlan, *ibid.*, 372, connects it to the Cretan philosopher Epimenides, known for his sobriety and abstinence; a connection to ἐπιμονή is closer to the manuscript evidence. Wescher (277) notes that while Theophrastus (*Historia Plantarum* VII:xii:1) has σκίλλης . . . τῆς Ἐπιμενιδείου καλουμένης, the reading is questionable, as Theophrastus adds ἢ ἀπὸ τῆς χρήσεως ἔχει τὴν προσηγορίαν. For discussion and bibliography see Garlan, *Recherches*, 372, and Dain, *Tradition*, 101–2. The nature of the compound is described in a scholion written at the top, left margin, and bottom of folio 3v, drawn from Philo Mech. (88:26–89:10); it is linked in the manuscript to the text by an asterisk above the word ἐπιμονιδίσις. The scholion is also in ms. B and published by Wescher (277–79), who titles it <Περὶ ἐπιμονιδίου φαρμάκου>. On the σκίλλη see Garlan, *Recherches*, 372.

46 **πλησμίσις . . . ἐμποιοῦσιν**: Cf. Philo Mech., 89:9–10: φάρμακον·

ἡδὺν γάρ ἐστι καὶ πλήσιμιον καὶ δίψαν οὐκ ἐμποιεῖ.

47 **μάλιστα ποιούμεθα πρόνοιαν**: Cf. Heron, *Bel.* 72:9: πᾶσαν πρόνοιαν ποιεῖσθαι.

47–49 **Καὶ ἐπεὶ . . . ἐπιστήμη**: Cf. Aristotle, *Topica* 163a:2–3: ἐπιχειρῶν ὅτι τῶν ἐναντίων μία ἐπιστήμη, ὅλως τῶν ἀντικειμένων ἀξιώσσειε μίαν εἶναι, and *Analytica Posteriora* 69b:10–12: προτείναντος δὴ μίαν εἶναι τῶν ἐναντίων ἐπιστήμην, ἢ ὅτι ὅλως οὐχ ἡ αὐτὴ τῶν ἀντικειμένων ἐνίσταται, τὰ δ' ἐναντία ἀντικείμενα. Cf. also John Philoponos, *In Aristotelis Analytica Priora commentaria* 13(2):478:27–479:1: Ἐὰν δὲ λέγῃ ἐκεῖνος ὅτι οὐχ ἡ αὐτὴ ἐπιστήμη τῶν ἐναντίων, ἐνστῶμεν οὕτως· τὰ ἐναντία ἀντικείμενα, τῶν ἀντικειμένων μία ἐστὶν ἐπιστήμη, οὐκοῦν τῶν ἐναντίων μία ἐστὶν ἐπιστήμη.

49–52 **οἱ . . . διάξουσιν**: On the husbanding and distribution of resources while under siege, see *De obsid.* 48:12ff.

51 **εὐταξία**: For concern with εὐταξία cf. the preface to Leo, *Taktika* (PG 673D–674A), where the term appears three times.

52–54 **Οὐκ ἀπεικὸς . . . καταναλίσκοντας**: Drawn with minor variations from Ath. Mech. 4:9–10.

54–56 **ἀνθηρολεκτοῦντάς . . . ψέγοντας**: The Anon. Byz. adds. For ἀνθηρολεκεῖν see Demetrakos, *Lexikon*, and Trapp, *Lexikon*, s.v.

57–61 **Κάλανον . . . εἰώθαμεν**: From Ath. Mech. 5:8–11; for Kalanos, the gymnosophist Sphinas who followed Alexander, called by the Greeks Kalanos, see *RE* X:1544–46. It is notable that a letter from Kalanos to Alexander is preserved by Philo Judaeus, *Quod omnis probus liber sit* (ed. F. H. Colson, *Philo, with an English Translation* [10 vols., London, 1941], IX:64) which has a quotation with a similar beginning, but quite different continuation (Ἐλλήνων δὲ φιλοσόφοις οὐκ ἐξομοιούμεθα, ὅσοι αὐτῶν εἰς πανήγυριν λόγους ἐμελέτησαν).

60 **βιωφελεστάτων**: The Anon. Byz. adds.

Chapter 4. Feints and Deceptions to Begin a Siege

The Anon. Byz. draws here on Philo Mech. 98:14–17 and 98:45–52 for the tactics of feint attacks, continuous attacks in relays at weaker sec-

tions of the walls, and use of noise and trumpets to frighten and confuse the enemy.

2 **στρατηγικώτατον ἄρχοντα**: For the superlative cf. Anna Comnena, *Alexiad* I:7:4 of her father Alexios and VII:2:5 of Nikephoros Bryennios, and Michael Psellos, *Chronographia* I:24:3 of Bardas Skleros. Below at **58:3** ἐξάρχοντες is used of the military leaders who will benefit from use of the Anon. Byz.'s work; that latter term is also used in the scholion below at *Geodesia* **6:13**. For the terms see R. Guiland, *Recherches sur les institutions byzantines* (Berlin-Amsterdam, 1967), I:380–404, “Le commandant en chef des armées byzantines,” esp. 393 on ἄρχων and *exarque*.

3 **αὐτοκράτορων**: The reference is apparently to multiple emperors and thus applicable to much of the first half of the tenth century, but may be used of sequential emperors; see also below, **58:6–7** θεοστέπτων καὶ φιλοχρίστων ἀνάκτων Ῥώμης.

4 **ἀποστάτας**: The term is used frequently by Anna Comnena for political “defectors”; see also M. McCormick, *Eternal Victory* (Cambridge, 1986), 187. Presumably that is the sense intended here, although it is difficult to find revolts in the first half of the tenth century requiring sieges. In ca. 922 Bardas Boilas in the citadel (ὀχύρωμα) of Paiperte was taken by John Kourkouas (Theophanes Continuatus, ed. I. Bekker [Bonn, 1838], 403–4), and in 932 the false “Constantine Doukas” was taken in the fort (φρούριον) of Plateia Petra (Theophanes Continuatus, 421); for an example of suppression of the ἀποστασία of the Slavs in the Peloponnese (probably 934), see *De admin.* 50:35–70 and for treatment of defeated defectors see *De aet.* 634:9ff. Martin (276) also suggests Melitene, captured in 934.

4–5 **τὰς . . . πρότερον**: Cf. Leo diac. (11:3–5) of Nikephoros Phokas preparing the siege of Chandax in 961: ἔννοια γοῦν ἐπὶ ἦλθεν αὐτῷ, κύκλω τὸ ἄστρῳ περιελθεῖν καὶ ἐς τὸ ἀκριβὲς τοῦτο κατασκοπεῖσαι, ἵνα ὅποι παρείκοι προσαγάγῃ τὸν πόλεμον, and Anna Comnena, *Alexiad* XIII:2 of Bohemond at Epidamnus: καὶ κατασκοπήσας τοῦ πολιορκεῖν ἤρξατο.

5–6 **καὶ τὴν . . . φύλαξιν**: Not directly in Philo Mech., but perhaps a summary of Philo Mech.'s recommendation, 96:43–46: βαλόμενος τὸ στρατόπεδον ἔξω βέλους ἐπὶ τοὺς ἀσφαλεστάτους τόπους, περιχαρακώσας

κύκλω ὡς ἂν ἦ δυνατὸν, εἶτα φύλακας καταστήσας ποιοῦ τὴν πολιορκίαν.

7 **καστρομαχεῖν**: See below on **10:1**.

10 **πρὸς τὰ σαθρότερα**: Cf. Philo Mech. 97:13: κατὰ τοὺς ἀσθενεστάτους τύπους . . . τὴν πρώτην ποιῆσαι προβολήν.

10–11 **ἐκ διαδοχῆς . . . ταγμάτων**: The Anon. Byz.'s paraphrase of Philo Mech.'s ἐκ διαδοχῆς στρατιωτῶν. On the tactic of continuous attack in relays, particularly the technical use of ἐκ διαδοχῆς, see Garlan, *Recherches*, 159ff, with caveats in F. E. Winter, review of Garlan, *American Journal of Archaeology* 80 (1976), 92, and R. K. Sinclair, "Diodorus Siculus and Fighting in Relays," *Classical Quarterly* 16 (1966), 249–55. Similar recommendations are found in Maurice, *Strategikon* X:9, Leo, *Taktika* XV:15–16 (following Onasander (XLII:7), and in the *Sylloge tacticorum* (104:6), and in great detail in Nikephoros Ouranos, *Taktika* 65:100–116, who recommends that the army be divided specifically into three teams, two teams resting while the third presses the siege. The *De re militari* (318:19ff) recommends "no let up by night and day in attacking the wall."

The term **τάγματα** (Philo Mech. uses it at 96:48: Δεύτερον δὲ λογισάμενος εἰς τάγματα ἢ ἐπαρχίας διαδώσεις τὰ γεώργια) is used here not in the technical sense of the four imperial regiments at Constantinople, but of smaller units of troops, perhaps equal to a βάνδον, a unit of about three hundred men, as frequently in Leo, *Taktika*, e.g., IV:2: Διαιρείσθω τοίνυν ὁ πᾶς ὑπὸ σὲ στρατὸς εἰς τάγματα, ἡγουν τὰ λεγόμενα βάνδα διάφορα, καὶ ἔτι ὑποδιαιρείσθω εἰς δεκαρχίας. On the term in this sense see Dennis, *Treatises*, 263 n. 1, and Dagron, *Traité*, 69 n. 18.

12 **σάλπιγγας**: The tactic is from Philo Mech., and perhaps best explained by Onasander, XLII:17: ἀκουσθεῖσα γὰρ πολεμία σάλπιγξ ἀπὸ τειχῶν ἐν νυκτὶ πολλὴν ἔκκληξιν ἐπιφέρει τοῖς πολιορκουμένοις ὡς ἤδη κατὰ κράτος ἐαλωκόσιν, ὥστε τὰς πύλας καὶ τὰς ἐπάλλξεις ἀπολιπόντας φεύγειν, although neither Philo Mech. nor the Anon. Byz. indicate that the trumpeters are actually already on the walls. Leo, *Taktika* XV:20 (following Onasander), also recommends use of trumpets to cause fear, while the *Excerpta Polyeni* 54:7 (ed. and trans. P. Krentz and E. Wheeler, *Polyaenus, Stratagems of War*, II [Chicago, 1994]) recommends use of trum-

pets all around a besieged city to deceive the besieged into thinking the city has been taken from all sides. See also Garlan, *Recherches*, 397.

14 **μεταπυργίων**: On the term for “curtain walls,” taken from Philo Mech., see Garlan, *Recherches*, 340.

Chapter 5. Objects Rolled Down From Cities on Hills

The Anon. Byz. draws here on Apollod. 139:9–12 (cf. Ath. Mech. 37:5–38:1 and Philo Mech. 94:32–33). The Anon. Byz.’s list omits Apollod.’s ξύλων κορμοί (“tree trunks”), adds κίονες, τρόχοι, and σφόνδυλοι (this last perhaps from Ath. Mech. 37:7), elaborates on Apollod.’s references to wagons and wicker containers, and adds the section on “barrels” and the concluding general reference to containers. The objects listed are illustrated in front of a fortification on a hill on folio 7v, the final four with labels (σφόνδυλος, τετράτροχος ἄμαξα, ἀγγεῖον πεπλεκμένον, ἀγγεῖον κυλινδρικό(ν)). The depiction of a column drum, labeled σφόνδυλος, helps clarify the use of the word σφόνδυλος in a poliorcetic context; see Demetrakos, *Lexikon*, s.v. no. 5, and Rochas D’Aiglun, “Athénée,” 800 n. 1, who translates as *meule*. See, however, another explanation offered by N. P. Milner, *Vegetius: Epitome of Military Science*, 2nd ed. (Liverpool, 1996), 125 n. 7. The illustration shows a hole in the center of the drum with a rod running through it (presumably to prevent the drum from falling flat while running downhill). See also Lendle, *Texte*, 187.

1 εἰ . . . **δυσβάτων**: For Apollod.’s Ἐὰν ἐπ’ ὄχθαις ὑψηλαῖς. The word λόφος appears in Apollod. 143:5 at the end of the section, introducing the related illustration. See below on **10:22–23**.

2 τὰ ἄνωθεν . . . **ἐναντίων**: The Anon. Byz. adds.

5 ἐκ πλοκῆς **διάφορα**: For Apollod.’s στρογγύλα.

6 **πεπιλημένης**: The Anon. Byz. adds.

6–8 καὶ οἶα . . . **ὕγροῦ**: The Anon. Byz. adds; for casks to store water during a siege cf. Maurice, *Strategikon* X:4:42–43: δεῖ ἢ πίθους ὀστρακίνους ἢ βούττεις τελείας προευντρεπίζειν καὶ γεμίζειν ὕδατος; and 49–50: ἐν τοῖς πίθοις ἤτοι βουττίοις (= Leo, *Taktika* XV:75).

Chapter 6. Wooden Tripod Barriers

The Anon. Byz. here interposes a solution to the problem of objects rolled against besiegers, drawing on Ath. Mech. (38:2–9), delaying Apollod.’s solution until the next chapter. He is apparently in error, however, in seeing Ath. Mech.’s τρίβολος and Apollod.’s ἔμβολον as separate devices; on the error see Lendle, *Texte*, 134 and n. 149. Blyth, “Apollodorus,” 152, also concludes that the two devices have the same function, but suggests that the ἔμβολα in the text of Apollod. are “introduced as something new and more elaborate.”

1–2 **τριβόλους** . . . **ξυλίνους**: Here not the spiked anticavalry weapon (on which see below, 11:19), but, in the Anon. Byz.’s interpretation of Ath. Mech., large tripodlike structures to repel heavy objects rolled downhill. They are so depicted on folio 7v. The noun is found in Ath. Mech.; the Anon. Byz. adds the adjective. The passages in which the term is used in various military applications are conveniently collected by F Lammert, *RE* VI:A:2:2413–15.

2 **λαβδαραίας**: The designation “*lambda*-shaped constructions” is added by the Anon. Byz. and is found in tenth-century treatises to describe other military devices. Leo, *Taktika* XI:26, so describes spear-tipped *μέναυλα* placed against *lambda*-shaped frames and set around a camp to prevent cavalry incursions; the passage is paraphrased by Nikephoros Ouranos, *Taktika* 65:69–70. On the passages see McGeer, “Tradition,” 134–35, and M. Anastasiadis, “On Handling the Menavlion,” *BMGS* 18 (1994), 1–10, specifically 2–3. At *De aet* 670:12, 671:1–2 **λαβδαρέαι** are mentioned, but without description, among the siege equipment for the Cretan expedition of 949; only four such items are specified in this list. Reiske, *De aet* (I: 670–71), explains “*arietes e duobus tignis ad angulum acutum instar Graeci λ commissis suspensos*,” but perhaps trebuchets. See also Du Cange, *Glossarium*, at **λαμβδαραία**.

Chapter 7. Ditch with Wall and Beak Tortoise

The Anon. Byz. draws here on Apollod. 140:3–141.3. For illustration of the ditch with fence, the latter labeled **πασσαλοκοπία** (a term found in Apollod.’s text at 143:4, τὰ ὑπογεγραμμένα σχήματα τῆς τάφρου, τῆς **πασσαλοκοπίας**, etc., but oddly not in the Anon. Byz.’s text) see folio

7v, and for the beak tortoise see folios 7v and 8r. For the Anon. Byz.'s "ausführliche, freilich durch Fehlinterpretationen beeinträchtigte Beschreibung der Schnabelschildkröte," see Lendle, *Texte*, 133–35, esp. 134 n. 149. Both the Byzantine text and accompanying illustrations differ significantly from the reconstruction of Apollod.'s device suggested by Lendle.

2–3 ἐκ . . . ἀρχομένους: The Anon. Byz. adds.

3–4 καὶ πρὸς . . . ἀνέρχεσθαι: The Anon. Byz. adds.

5 τοῖχον: The term is from Apollod.; on its use for any lesser wall see Garlan, *Recherches*, 331 and 391, and Lawrence, *Fortification*, 72.

7 προτείχισμα: The Anon. Byz. adds.

9 νεάκια: The Anon. Byz. adds. Martin, following Du Cange, *Glossarium*, cites parallels for the word in the *De obsid.* and the *Parekbolai* (for both texts see *De obsid.* 49:18 with van den Berg's n.18) and translates "troncs de jeunes arbres"; Schneider renders "Äste." The word is also found at Leo, *Taktika*, Appendix (1104:5–8), and Nikephoros Phokas, *Praecepta militaria* I:120, where McGeer translates "saplings."

10 ἐπ' ἀριστερά: This detail is an addition here and below by the Anon. Byz.; thus the wall would be on the troops' left side as they advanced.

11–12 λελοξευμένα . . . κλίσιν: The Anon. Byz. appears (as Martin notes *ad loc.*) to misinterpret Apollod.'s πάσσαλοι . . . λοξούμενοι τῷ αὐτῷ κλίματι ("stakes having the same inclination").

13 κλάδους . . . περιδεσμείν: For Apollod.'s κλάδων ἀγκαλίδες περιδέονται. Martin (*ad loc.*) notes that the participle refers to the subject of the infinitive and has κλάδους as its object, yet translates "attacher tout autour des branches d'arbres réunies en fagots." Schneider renders "umwinden sie mit biegsamen Baumzweigen." On ἀπαγκαλίζειν see F. Adrados, *Diccionario griego-español* (Madrid, 1986), s.v. doblar, citing only this passage.

13–15 καὶ τὴν . . . ἀναβάσεις: The Anon. Byz. adds.

17–22 τουτέστι . . . τοξικίων: The Anon. Byz. adds. The geometrical

descriptions (note συνεστώσας) are characteristic. On the terms see below on 7:21 and 22.

21 ἐπισκηφθέντων: Martin (*ad loc.*), whose later manuscript read ἐπὶ συνφιθεισῶν, emended to ἐπισυσφιγγθείσαις (as does Wescher) and reasonably suggested “il est évident, par la description qui précède, que ces tortues doivent être comparées à des proues détachées des navires, renversées à terre de manière à présenter la carène en haut, et serrées les unes contre les autres.” This accords well with the illustration of the beak tortoise on folio 8r. Schneider emended to ἐπισκηφθέντων, which seems the simplest. For the prows of ships being used to ram walls, see Philo Mech. 95:23–24: τῶν μεγάλων σκαφίων ἔμβολος εἰς τὸ τεῖχος ἐμβάλη; and 99:6–8: Ποιητέον δ’ ἐστὶν καὶ ἐμβολὰς εἰς τὰ μεταπύργια τῶ ἀχρειοτάτῳ τῶν μεγάλων σκαφῶν.

22 τοξικίων: The precise nature of the comparison is uncertain; Dain, *Tradition*, 159 n. 2, suggests “Il s’agit d’un nom donné à certains navires.”

22–24 μικρὰς . . . φέρεσθαι: The Anon. Byz. adds here, but see the same recommendation below, 13:35–38, from Apollod.

24–25 καὶ . . . ἥλους σιδηροῦς: Wescher (*ad loc.*) and Schneider (*ad loc.*) detected corruption in the text of Apollod. (140:11–12) that the Anon. Byz. interprets here; Blyth (“Apollodorus,” 134 and n. 18) saw the work of a redactor and careless copyist; Lendle (*Texte*, 133 n. 148) attempts to retain the readings. The manuscript readings of Apollod. appear to suggest an alternative, smooth beams for dragging or iron wheels. The Anon. Byz. has suggested a combination of smooth beams and iron nails to secure the device when on the ground.

27–28 ὡσπερ . . . ἄμαξαι: The simile is added by the Anon. Byz. If pressed literally, the comparison would not seem to illustrate clearly a pole that would secure the tortoise in position, as Lendle, *Texte*, 135, argues.

28–29 ἴνα . . . ἐπιστηρίζῃ: For Apollod.’s κατὰ τὴν ὑποστροφὴν ἐρεῖδον.

29–30 καὶ μάλιστα . . . μέλλωσι: The Anon. Byz. adds here, perhaps influenced by Apollod. 142:1: ἀναπαύειν τοὺς φέροντας (cf. below 10:14–15).

Chapter 8. The Wicker Tortoise

The Anon. Byz. draws here on Philo Mech. 99:29–37 (Ποιοῦνται δὲ αἱ γεροχελῶναι ἐκ τῶν πλεχθέντων γέρρων ἄνωθεν ἐς ὀξειαν γωνίαν συγκλεισθέντων πρὸς ἄλληλα, ὡσαύτως δὲ καὶ ἐκ τῶν πρόσθεν; in Philo Mech. they are then covered with hides and set on beams with rollers). For illustration of the device see folio 7v; see also above, 2:5.

3–4 *ιτείνων* . . . *μυρικής* . . . *φιλύρας*: The Anon. Byz. substitutes for Philo Mech.'s γέρρων, apparently reflecting contemporary practice. Cf. *De obsid.* 50:5–6: ἀθροίζειν δὲ καὶ κληματίδας καὶ βέργας ιτείνας ἢ μυρρινίας πρὸς ποίησιν λαισῶν; and Nikephoros Ouranos, *Taktika* 65:86–88: λαίσας εἴτε ἀπὸ κλημάτων ἀμπελίων, εἴτε ἀπὸ βεργίων ιτέας, ἢ ἀπὸ μυριχίων.

Chapter 9. The Laisa

For a discussion of the etymology of the term *λαίσα* and its appearance here and in various other tenth/eleventh-century sources see McGeer, “Tradition,” 135–38. *Laisai* are illustrated on folios 8r and 35r.

2–3 *ἐν σχήματι τροπικῶν*: For ἡ τροπική as “arch” see C. Mango, “On the History of the Templon and the Martyrion of St Artemios at Constantinople,” *Zograf* 10 (1979), 4 and n. 16. The *laisai* illustrated on folios 8r and 35r show a rounded arch; for the phrase cf. below, 10:12–13 *ἐν σχήματι* . . . *χελώνης*, 17:12–13 *ἐν σχήματι* κηπουρικοῦ πλατυλισγίου, and 44:36–37 *ἐν σχήματι* παλιντόνου ἀγκῶνος. It is worth noting that Nikephoros Ouranos, *Taktika* 65:88–89, says of the shape of the *laisa*: τὸ δὲ σχῆμα αὐτῶν ἵνα εἰσὶν τροπικῶς οἴκου. ἔστω δὲ τὸ ἐπάνω μέρος οἶον τὸ στέγος αὐτῆς καὶ ὀξύτερον. He adds that they should have two doorways (θυρίδων) with enough room for fifteen to twenty men. On the passage see McGeer, “Tradition,” 135. The Anon. Byz. may have smaller versions in mind; the illustration on folio 8r shows 4 men, that on 35r a single man.

Chapter 10. Vine Tortoise

The Anon. Byz. draws here on Apollod. 141:5–143:5. For technical discussion of the vine tortoise and the Anon. Byz.'s interpretations of Apollod., see Lendle, *Texte*, 136–41, and Blyth, “Apollodorus,” 134. The

frame of the tortoise is illustrated on folio 8r; a modern drawing is given by Lendle, *ibid.*, 139.

1 **καστρομαχίαν**: For Apollod.'s πολιορκία. For the term cf. Theoph., I:379:18–20: παραδεδοκῶς αὐτῷ πρὸς καστρομαχίαν κριόν . . . ἐντειλάμενος αὐτῷ, τὰ μὲν τείχη Χερσῶνος ἐδαφίσαι, *De aer.* 670:10: διὰ τῆς ἐξοπλίσεως καστρομαχίας, with a list of equipment and engines for the Cretan expedition of 949, and J. Haldon, *Constantine Porphyrogenitus, Three Treatises on Imperial Military Expeditions* (Vienna, 1990), C:196–97: βιβλία μηχανικά, ἐλεπόλεις ἔχοντα, καὶ βελοποιικὰ καὶ ἕτερα ἀρμόδια τῇ ὑποθέσει ἡγουν πρὸς πολέμους καὶ καστρομαχίας. The Anon. Byz. uses the term here as an aspect of a siege (πολιορκία), specifically the attack on the fortifications. See also above, 4:7. On κάστρον (castle, citadel of a city, the fortified city as a whole), see *ODB* II:1112, and J. F. Haldon and H. Kennedy, “The Arab-Byzantine Frontier,” *Zbornik Radova Vizantolškog Instituta* 19 (1980), 76–116, esp. 94–96 and nn. 56 and 60.

1 **λαός**: For Apollod.'s ὄχλος.

2–3 **πρὸς τὰ πλάτη τῶν ἐμβόλων . . . ἦτοι τῶν χελωνῶν ὀπισθεν**: The Anon. Byz. here interprets, adding the final explanatory phrase, a difficult passage in Apollodorus that seems to suggest that the troops are in the area between the two rear sides of the beak tortoises. The text of Apollod. reads: Ἀκολουθήσει δὲ ὁ ὄχλος ὁ ἐργαζόμενος τῇ πολιορκίᾳ χιτῶνα ἔχων, ὃς ἔσται (Sch. conl. ἔγεται) εἰς τὰ πλάτη τῶν ἐμβόλων. See Lendle, *Texte*, 137, and Lacoste, “Poliorcétiques,” 237 n. 3.

4 **ξύλα**: For Apollod.'s κάμακας (vine-poles).

5–10 **ἄνισα . . . ἔστωσαν**: The Anon. Byz. introduces here a characteristic of the design that only appears at the very end of the Apollod. text. Blyth, “Apollodorus,” 134 and n. 18, argues that the vertical poles are a later addition to the Apollod. text and at variance with the original design, that the Anon. Byz. has in his description tried to reconcile this irreconcilable confusion.

6–7 **κατὰ δὲ πέντε πόδας**: The text of Apollod. is corrupt here. For discussion of the Anon. Byz.'s interpretation see Lendle, *Texte*, 138, and Lacoste, “Poliorcétiques,” 238 n. 2.

11 **ἀναδενδράσιν**: The comparison is added by the Anon. Byz. For

Byzantine examples see Koukoules, *Bios*, V:282.

12–13 ἐν σχήματι . . . χελώνης: For Apollod.'s ἵνα τὸ ὑπ' αὐτῶν σχῆμα ἦ χελώνη. As Lendle, *Texte*, 136, notes, we can only conjecture what type of tortoise Apollodorus had in mind; Lendle opts, based on various similarities, for the ram-tortoise. See his illustration, *ibid.*, 137.

14 ὡς ξίφη: For Apollod.'s στύρακας (“spikes at the butt-end of spears” cf. Kolias, *Waffen*, 199 n. 85). For ξίφος as “point,” “spike” see, *ibid.*, 195 n. 67.

15–16 Δέρματα . . . λίνια παχέα, ἢ τρίχινα: The text here is problematic. Martin (*ad loc.*) suggested that the Anon. Byz. was reacting to a corruption in the text of Apollod. at 144:2, δέρρεις ἢ λινᾶς ἢ τριχίνας, “linen” skins making no sense. Martin proposed to emend the text of Apollod. with λείας for λινᾶς (thus, “skins, either smooth or hairy”), noting that at 146:4-5 Apollod. speaks of δέρρεις τρίχιναι, but argued that the Anon. Byz. actually wrote λίνια here out of respect for his source. Whether two or three coverings are in question is also unclear. The reading of V is τρυχίνα (sic), “ragged,” and perhaps the Anon. Byz. uses it, trying to remain close to his source, as equivalent to ῥάκος (“patchwork” = *centones*, on which see the commentary on 13:21). Notably below at 13:20–21, where he also paraphrases Apollod. 144:2, the Anon. Byz. writes δέρματα ἢ ῥάκη σκέποντα, ἢ τὰ ἐκ βεργῶν ἢ φοινίκων πεπλεγμένα. Schneider, who prints Δέρματα δέ, ἢ λινᾶ παχέα, ἢ τρίχινα, translates “Häute, Sackleinen oder Filzdecken.” On protective body armor made ἐκ λίνου see Kolias, *Waffen*, 152–55.

20–21 ἵνα . . . ἐκλύηται: For Apollod.'s ἵνα ἐκλύηται τὰ πεμπόμενα.

22–23 Τὰ δὲ ὑπογεγραμμένα . . . ὑπόκεινται: The reference is to the group of illustrations on folios 7v and 8r that depict the devices described in chaps. 5–10. The list in Apollod. (143:3–5) is much more specific: Καὶ ἔστι τὰ ὑπογεγραμμένα σχήματα τῆς τάφρου, τῆς πασσαλοκοπίας, τοῦ ἐμβόλου, τῆς ἀμπέλου, τῆς χελώνης, καὶ τοῦ λόφου σχῆμα.

Chapter 11. Filler Tortoises, Probes for Various Traps

The Anon. Byz. here combines and elaborates on passages from Philo

Mech.: 99:41–44 (filler tortoise as wheeled and covered in front), 85:23–29 (burying pots over which men can safely walk, but which siege engines cause to collapse), 100:4–6 (probing for buried pots and hidden ditches), 100:6–11 (probing for doors and caltrops), 99:11–13 (secretly undermining walls), and 99:18–19 (using smoke against miners). On the *χωστρίδες* see above, **2:2**, and cf. Anna Comnena, *Alexiad* XI:1:7: τὸν ἐκτὸς τούτων διακείμενον τάφρον ὡς ἐν ῥιπῇ πληρώσαντες κόνεως, ὡς εἰς μίαν ἐπιφάνειαν συναφθῆναι ταῖς ἐφ’ ἐκάτερα παρακειμέναις πεδίασιν. The device is illustrated on folio 8r, lower right.

1–2 (E)ἰ . . . κείμεναι: Cf. above, **5:1**. The contrast, not in his classical source, may be the Anon. Byz.’s own; Wescher (209 n. on line 3), however, suggests that there may be a lacuna in the text of Apollod.

2 ὑποτρόχους: For Philo Mech.’s τροχούς . . . ἔχουσαι.

4 ἀπὸ τῶν ἐναντίων: The Anon. Byz. adds.

4 πλήττωνται: For Philo Mech.’s τιτρώσκονται.

5 λαΐσας: The Anon. Byz. adds; see above on **2:4** and cf. *De obsid.* 74:18: εἰ δὲ καὶ λαΐσας χωστρίδας οἱ ἐχθροὶ ἐπινοήσαιντο.

5–9 χρησίμους . . . ποιησώμεθα: The explanation is not in Philo Mech., and apparently is the Anon. Byz.’s addition.

6 ἐνύδρους καὶ ὑπόμβρους: Philo Mech. twice (82:28, 97:27) uses the clause ἐὰν μὴ ὑπομβροσὶ ἢ ὁ τόπος; the elaboration is apparently the Anon. Byz.’s own.

7 ἀναγεμίζειν: For the compound see Demetrakos, *Lexikon*, s.v., and cf. below, **12:15**, **15:6** and **19:2**.

7 λακκίσματα: Philo Mech. mentions (85:30) among defensive preparations for a siege digging τέλματα and (100:23) besiegers filling them in; the later term is the Anon. Byz.’s substitution. On Philo Mech.’s term see Winter, *Fortifications*, 270–71.

7 ἐξομαλίζειν: Cf. Josephus, *Bellum Judaicum* V:106–108:1: ἐξομαλίζειν τὸ μέχρι τοῦ τείχους διάστημα . . . ἀνεπλήσθη μὲν τὰ κοῖλα καὶ χαραδρώδη τοῦ τόπου.

7–8 τοῖς τείχεσι πλησιάζοντα: Schneider translates “und so geht man bis dicht an die Mauer heran.”

12 κεράμια: The term is from Philo Mech.; it appears below in *Geodesia* 9 as a technical unit of liquid measurement. The nontechnical use and context here would seem to justify the translation “clay pots”; I retain *keramia* in the latter passage. On the tactic see Garlan, *Recherches*, 365–66. The Anon. Byz. omits Philo Mech.’s additional comment, σάξαντας τὰ στόματα φύκει· ἄσπυτον γάρ ἐστι.

12–14 τοῖς μὲν ἀνθρώποις . . . καταδύνειν: The Anon. Byz.’s elaboration with added explanation on the weight of the machines for Philo Mech.’s ὥστε τοὺς μὲν ἀνθρώπους μηθὲν πάσχειν δεινὸν ἐπ’ αὐτῶν βαδίζοντας, τὰς δὲ προαγομένας χελώνας καὶ μηχανήματα ἐπ’ αὐτῶν καταδύνειν.

14–15 καὶ διασπᾶσθαι . . . κεραμίων: The Anon. Byz. adds.

16–17 μετὰ . . . ἐπιτηδείων: The Anon. Byz.’s elaboration for Philo Mech.’s σειρομάσταις. On σειρομάστης as εἶδος ἀκοντίου see Souda IV:347:21 and Kolias, *Waffen*, 178.

16 ἀκοντίων: The Anon. Byz. chooses the classical term; on ἀκόντιον for μέναυλον see Kolias, *Waffen*, 194. On the latter see also J. Haldon, “Some Aspects of Byzantine Military Technology from the Sixth to the Tenth Centuries,” *BMGS* 1 (1975), 11–47, esp. 32–33.

16 λόγχας: On the use of the word for the “point” of a spear see Leo, *Taktika* XX:116 (1044D), XX:188 (1064C), τῶν κονταρίων τὰς λόγχας, and Kolias, *Waffen*, 195.

19 σιδηροῦς τριβόλους: Here the small anticavalry or antipersonnel spiked metal ball (see Dennis, *Treatises*, 263 n. 2), illustrated on folio 8r. The adjective is to distinguish it from the large wooden barrier devices of the same name (see above on 6:1–2). Cf. Leo, *Taktika* VI:27, in a list of infantry equipment: τριβόλους ἀναδεδεμένας διὰ λεπτῶν σφηκωμάτων, καὶ ἐν ἥλωσι σιδηρῶ ἀποκρατουμένας, διὰ τὸ ἐτοίμως συναγαγέσθαι αὐτάς, and Procopius, *De bello gothico* VII:xxiv:16–18.

20 ὑποθέματα: On the tactic see Garlan, *Recherches*, 399 n. 44b.

20 ὑποδήμασι: For Philo Mech.'s ἐνδρομίδης (“a soldier’s high boot,” LSJ). On the ὑπόδημα in the middle Byzantine period as a high military boot replacing greaves, see Koliass, *Waffen*, 72; McGeer, *Warfare*, 62; and Koukoules, *Bios*, IV:414.

21 γεωργικοίς: For κηπουρικοίς in Philo Mech.

22 γριφάνας: The term is added by the Anon. Byz. Cf. Hesychius, gamma, 924:1: (γριφᾶσθαι)·γράφειν. οἱ δὲ ξύειν καὶ ἀμύσσειν· Λάκωνες, and *The Oxford English Dictionary*, 2nd ed. (Oxford, 1989–), at “griffaun,” “graffane”: “a grubbing ax.” The illustration on folio 8r shows a tool very similar to a modern rake being used to dig up the caltrops.

24 δικέλλαις: The term is from Philo Mech. and not illustrated in the manuscript. On the Byzantine tool see A. Bryer, “Implements,” 70 and fig. 16; A. Harvey, *Economic Expansion in the Byzantine Empire, 900–1200* (Cambridge, 1989), 124; and M. Kaplan, *Les hommes et la terre à Byzance* (Paris, 1992), 48. Cf. *Miracula Demetrii* 154:7–8: τὰς χελώνας καὶ τοὺς μοχλοὺς καὶ τὰς δικέλλας καταλείψαντες ἔφυγον . . . οἱ πολέμιοι. See also below, 17:13 for other implements.

27–29 ἴνα . . . ἀπολέσωσι: On methods of counteracting tunneling/undermining see Polybius XXI:28:11–17 (repeated in *De obsid.* 76:22–77:16), smoke from burning feathers and charcoal; Anna Comnena, *Alexiad* XIII:3, the siege of Dyrrachium in which the tunnelers are driven off with fire from a resin-sulphur mix on reed tubes; and Whitehead, *Aineias*, 199 nn. 37:1ff and 37:3. For examples of tunneling/undermining as a siege method see, for example, Dahabi, in A. A. Vasiliev, *Byzance et les Arabes*, Fr. ed. by H. Grégoire and M. Canard, 3 vols. [Brussels, 1935–68], II.2:242. Dahabi indicates that a Byzantine attempt on Amid in 951 involved “une galerie souterraine d’une longueur de 4 milles,” but this failed when discovered by the inhabitants. See also Leo diac. (25:19–26:8), undermining the walls of Chandax in 961 (heavily modeled on Agathias’ description of Narses’ siege of Cumaë); Anna Comnena, *Alexiad* XI:1, undermining the walls of Nicaea, and XIII:3, tunneling to and undermining the walls of Dyrrachium; and esp. Nikephoros Ouranos’ recommendation of it above all other methods, *Taktika* 65:139–42.

Chapter 12. Tactics to Induce Capitulation.

The Inflatable Ladder

The Anon. Byz. combines here two separate passages from Philo Mech., the first (96:27–34) on siege tactics ending κλίμακας ἐτοιμούς ἔχοντας λάθρα πλησιάσαντας τῷ τείχει, the second (102:12–19) beginning Κατὰ κλοπὴν μὲν νυκτὸς ἢ τὰς σκυτίνας κλίμακας προσθέντας. The illustration on folio 9v shows a ladder with both sidebars and rungs stitched, indicating that in the view of the illustrator the whole device was inflatable; the rope net with hooks over the wall is also clearly shown. A similar rope ladder with hooks is also shown on folio 35v.

1 εὐκόπως πορθεῖν: For Philo Mech.'s λήψεσθαι. The term seems strong given ὑπόφορον below. Rochas D'Aiglun translates with “s’emparer” and Schneider “erobern.” For the force of πορθεῖν see Garlan, *Recherches*, 24.

2 Ἀθηναῖον: Philo Mech. is said to be “of Byzantium” by Vitruvius, Heron of Alexandria, Eutocius, and the Anon. Byz. himself below at 48:1. Ath. Mech. (15:13) calls him “Athenian,” apparently the source of the contradiction. For discussion see Garlan, *Recherches*, 284, and Schneider, *Athenaios*, 59–60 n. on 15:13.

3 ἀθρόαν: The Anon. Byz. adds.

4–6 εὐάλωτον . . . ἔξειν: For Philo Mech.'s ῥαδιέστατ' ἂν λάβοις τὸ ἄστυ.

7–8 τῶν πολιτῶν . . . ὄντων: The Anon. Byz. adds.

8 ἀνεπίστων: Cf. Thucydides 3:30:2: θάλασσαν . . . ἢ ἐκεῖνοί τε ἀνεπίστοι ἐπιγενέσθαι ἂν τινα σφίσι πολέμιον.

9–10 ὅτε . . . τυγχάνουσιν: The Anon. Byz. adds.

11–12 τοῦ πλήθους . . . σχολάζοντος: The Anon. Byz. adds.

13 κλίμακας . . . δερματίνας: The device is from Philo Mech. who uses σκυτίνας; the illustration of the ladder (folio 9v) retains Philo Mech.'s term, perhaps indicating a similar illustration was in a text of Philo

Mech. available to the Anon. Byz. or his illustrator. While the device seems fanciful, for the use of inflated skins for swimming support see esp. Xenophon, *Anabasis* III:v.9–11: ἂ ἀποδαρέντα καὶ φουσηθέντα ῥαδίως ἂν παρέχοι τὴν διάβασιν. For general discussion with classical references see J. Hornell, “Floats and Buoyed Rafts in Military Operations,” *Antiquity* 19 (1945), 72–79.

15–16 ὥστε μὴ διαπνεῖν: The Anon. Byz. adds.

16–18 ἐμφουσωμένων γὰρ . . . ἀνάβασιν: The Anon. Byz. adds.

18–19 Εἰ . . . εἴη: The Anon. Byz. adds.

19 **στουπίναις**: The term is Philo Mech.’s. On the use of flax/linen for netting in Byzantium, see Koukoules, *Bios*, V:331ff. On nets and rope ladders for climbing, cf. Aeneas Tacticus 38:7 (δικτύων συείων ἢ ἐλαφείων ἢ ταῖς ἐκ τῶν σχοινίων κλίμαξι) and Vitruvius X:15.7.3 with Callebat and Fleury, *Vitruve*, *ad loc.* See also below, **44:35** and **49:3**.

21 **δικτυωταὶ . . . τὰ λεγόμενα σάρκινα**: The Anon. Byz. adds. For the use of the Latin term (e.g., Caesar, *Bellum Gallicum* II:17, “hanc <i.e., primam legionem> sub sarcinis adoriri”), cf. Maurice, *Strategikon* X:3:9–11 (= Leo, *Taktika* XV:48, and *Problemata* X:11): Ἀντίκεινται δὲ ταῖς τοιαύταις βολαῖς κιλίκια κρεμάμενα ἔξωθεν τοῦ τείχους κατὰ τοὺς προμαχῶνας, σάρκινα, σχοινία εἰλημμένα, πόντιλα κρεμάμενα.

22–23 ἀπὸ . . . **δερματίνων**: The Anon. Byz. adds.

24 **προμαχόνων**: The term is from Philo Mech.; see also at *Geodesia* **2:14** where the same term is taken from Afric., *Cest*.

24–25 καὶ οὕτως . . . **διευθετίζωσι**: The Anon. Byz. adds.

Chapter 13. Tortoise for Excavating

The Anon. Byz. here draws on Apollod. 143:6–144:11. The device, which protects sappers excavating through walls, is illustrated in position against a curtain wall with merlons and between towers on folio 11r, labeled *χελώνη ὀρυκτρῖς*; two men dressed in calf-high boots, thigh-length tunics (*καβάδια*), and felt hats (*καμελαύκια*), each wielding a two-pronged pick, are depicted excavating one side of a similar fortification on folio

11v, with the wooden props and fire depicted on the other side; finally, another similar tortoise labeled *χελώνη ὀρυκτρὶς πηλῶ ἐπικεχρισμένη* is depicted on folio 12v. For the device see also Ath. Mech. 19:3–20:3; Vitruvius X:15:1; Callebat and Fleury, *Vitruve*, 262–63; Garlan, *Recherches*, 351, and above, 2:2.

1–2 (Τ)ὰ . . . ἀμπελοχελώναις: The Anon. Byz. adds.

1 ἀνωτέρω προρρηθέντα: See 7:15ff.

3 διαφόρους: For Apollod.'s πολυτρόπους.

4–5 τὰς λεγομένας ὀρυκτρίδας: Apollod. does not name the device in his description, but does use the phrase *χελωνῶν διορυκτρίδων* in his table of contents (138:19). Ath. Mech., in his brief description, uses the phrase *τῆς ὀρυκτρίδος χελώνης*; Anna Comnena, *Alexiad* XIII:2:3, uses *ὀρυκτρίδας*.

5–9 ταύτας . . . οὕτως: The Anon. Byz. adds.

5 διρρύτους: On the term see Trapp, *Lexikon*, s.v., who gives “mit zweiseitig abfallendem Dach, mit Satteldach.” It is added here by the Anon. Byz. Such a triangular form is also found in Vitruvius (X:15:1): “Quae autem testudines ad fodiendum comparantur . . . frontes vero earum fiunt quemadmodum anguli trigoniorum, uti a muro tela cum in eas mittantur, non planis frontibus excipiant plagas sed ab lateribus labentes, sine periculoque fodientes, qui intus sunt, intuentur.” This form of the tortoise is not described or depicted; see below on 13:7 and cf. ὀξύρρυτος at 22:11.

7 μονόπερους: The term, added by the Anon. Byz., is contrasted with διρρύτους and thus apparently refers to a tortoise with a single slanting roof, like a lean-to, which accords with the Anon. Byz.'s description and the illustrations on folios 11r and 12v. Barocius renders “unicam habentes alam retro,” Schneider (note, pp. 21–23) “Pultdach,” suggesting a connection with the architectural use of τὸ πτερόν as “Schwebedecke,” also μονόπτερος ein Gebäude mit einem Dache.” Closer parallels for τὸ πτερόν as a defensive barrier may lie with Procopius, *De aedificiis* II:8:14: ὅπερ ἀποκρούεσθαι διὰ σπουδῆς ἔχων οἰκοδομίαν τινὰ τῇ τοῦ περιβόλου ὑπερβολῇ ἑτέραν ἐνήψε κατ’ αὐτὸ μάλιστα τὸ τῶν

σκοπέλων γειτόνημα, προκάλυμμα τοῖς ἐνθένδε μαχομένοις ἀεὶ ἐσομένην. πτερὰ τὴν οἰκοδομίαν καλοῦσι ταύτην ἐπεὶ ὡσπερ ἀποκρέμασθαι τοῦ τείχους δοκεῖ, and with the interesting device described in the *Scholia in Euripidem (scholia vetera) in Phoenissas* 114: ἄλλοι δὲ ἔμβολά φασι τοὺς καθέτας, τὰ νῦν καλούμενα πτερὰ, ἅπερ ἐστὶ τῆ κατασκευῆ τοιαύδε. θύραν κατασκευάσαντες ἴσην κατὰ τε μῆκος καὶ πλάτος τῆ πύλῃ τοῦ τείχους ἔξωθεν αὐτῆς χαλκῶ πέταλα καθηλοῦσιν ὡς ὀλόχαλκον τὴν θύραν νομίζεσθαι. ταύτην ἐπάνω τῆς πύλης ἴστασαν οὐχ ἐδραϊάν ἀλλ᾽ ὡσπερ κρεμαμένην. τῶν δὲ πυλῶν κλειομένων καθίεσαν ἄνωθεν τὴν κεχαλκωμένην θύραν, ἥτις μέχρι τοῦ ἐδάφους φθάνουσα ἐκάλυπτε τὰς πύλας ὡς ἂν μηδεμίαν ἐπιβουλήν γίνεσθαι ἔσθ' ὅτε καὶ πυρὸς προσφερομένου ταῖς πύλαις ξυλίταις οὐσαις. καὶ πολεμίων μὲν πολιορκούντων τὰς τε πύλας ἔκλειον καὶ τὰ ἔμβολα καθίεσαν· εἰρήνης δὲ οὐσης διὰ τὸ τὰς πύλας οὐσας μεγάλας δυσχέρειαν παρέχειν ἔν τε τῷ κλείεσθαι καὶ ἀνοίγεσθαι, ταύτας μὲν εἶων ἀνεωγμένους διὰ παντός, ἐσπέρας δ' ἤρκοῦντο τῷ ἐμβόλῳ διὰ τινος μηχανήματος αὐτὸ καθιέντες καὶ ἀνέλκοντες. ἔμβολον καλεῖ ἐκ τοῦ ἄνωθεν ἀπὸ τοῦ τείχους ἐμβάλλεσθαι ἔξωθεν τῶν πυλῶν, χαλκόδετον δὲ διὰ τὸ δεδέσθαι καὶ ἡσφαλίσθαι χαλκῷ. The phrase μονόπτερα πλεκτά, ὡς δῆθεν ψιάθιον in Nikephoros Ouranos, *Taktika* 65:95, apparently refers to plaited screens on *laisai*.

8 *τραπεζοειδεῖς ὡς τριγώνους*: The Anon. Byz. adds this description; the phrase seems awkward as the sides of the tortoise would appear to be specifically triangular rather than trapezoidal. Schneider renders “eine unregelmässige Figur, so ziemlich ein Dreieck.” For similar geometric influence on description of a tortoise see Anna Comnena, *Alexiad* XIII:3:1: Μικρὰν τινα χελώνην . . . ἐν παραλληλογράμμῳ σχήματι.

10–11 *διὰ . . . ἔργου*: The Anon. Byz. adds.

12 *ὁμοίως . . . πλάτος*: The Anon. Byz. adds.

13 *λοξῶς*: The Anon. Byz. adds.

13 *πρὸς ὄνοχα*: The phrase here is from Apollod.; the Anon. Byz. adds it again at **13**:19 and at **49**:12 in his own description of a triangular drop-bridge.

13–14 *ὑποτρόχων ἀξόνων*: The Anon. Byz. adds here; only at the end

of his description of both the tortoise and the excavating operation does Apollod. mention that the tortoises are wheeled, a mention repeated by the Anon. Byz. at **15:21**. For the view that the oddly positioned addition of wheels as well as the nails and clay covering in Apollod.'s text are due to a later redactor, see Blyth, "Apollodorus," 135.

14 **προσεγγίωσι**: For Apollod.'s ἐφαρμόζει: that is, the diagonal cut allows the slanting beam to fit flush against the wall.

15 **ὑπόθεμα**: The term is from Apollod.; see Marsden, *Treatises*, 160 n. 20, "a strengthening plate fixed beneath," and Marsden, *Development*, 20 and 29. See also below, ὑπόθημα, **39:3**.

16 **τὰ ὑποστηρίζοντα**: For Apollod.'s τὰ λοξὰ καὶ τὰ ἐρείδοντα.

17–18 **ἵνα . . . παρεκπίπτῃ ὀπισθεν**: For Apollod.'s ὅπως ἅπαντα τὰ ἐπιβαλλόμενα ὀλισθαίνῃ.

18–19 **Τὰ . . . ἐκκεκομμένα**: For Apollod.'s τὰ ἄκρα τῶν ξύλων τούτων.

21 **παρασύρονται**: For Apollod.'s ῥέμβηται.

21–22 **δέρματα . . . πεπλεγμένα**: For Apollod.'s δέρρεις ἢ λινᾶς ἢ τριχίνας: see above on **10:15–16**.

21 **ράκη**: Rochas D'Aiglun, "Athénée," 185 n. 1, suggests that ῥάκη = Latin *centones*, citing Caesar, *Bellum Civile* II:9: "Coria autem, ne rursus igne ac lapidibus corrumpantur, centonibus conteguntur," as well as Vegetius IV:15. On *cento* (κέντρον) see Dar.-Sag., *Dictionnaire*, I:1013: "couverture ou vêtement fait de pièces cousues ensemble. . . . Les Romains, sachant que la laine brûle difficilement, revêtaient d'épais centons de cette étoffe les galeries d'approche qu'ils employaient dans les sièges." See also *RE* III:1932–33, with references to military uses. The term is also found below at **15:9** and **55:15**. Cf. also the use of felt (κέντουκλον), e.g., at *De cer.* 670:17 and 671:11 with discussion in Kolia, *Waffen*, 58.

22 **φοινίκων**: The Anon. Byz. adds; palm is recommended for its resilience by Ath. Mech. (17:14, on a filler tortoise), a passage cited by the Anon. Byz. (**39:10**) and perhaps the source for the recommendation here. Philo Mech. makes similar recommendations (91:4–6, hung on

fortification walls to protect against stone throwers, and 97:24, 98:8, on portable towers). On its properties and geographical range of availability see Lawrence, *Fortification*, 70, 88 n. 3, and 101, and F. Lammert, *Jahresbericht über die Fortschritte der klassischen Altertumswissenschaft* 274 (1941), 57; for references to it in the classical sources see Callebat and Fleury, *Vitruve*, 260 n. 3.2. On availability of wood supplies generally see Dunn, “Exploitation,” also, Meiggs, *Trees*, esp. chap. 6, “Timber for Armies.”

23 ἐκατέρωθεν: For Apollod.’s πλαγίως.

23–24 ὡσαύτως . . . ἔμπροσθεν: The Anon. Byz. adds these front covers, apparently to protect men putting the tortoise into position.

24–25 Ὄταν . . . ἔμπροσθεν: The Anon. Byz. adds.

29–30 τὰ . . . κατερχόμενα: For Apollod.’s ἡ ὀρυσσομένη γῆ.

30 πρὸς τὸν ἐαθέντα . . . τόπον: For Apollod.’s ποῦ ἀποβληθῆ.

30–32 ἐπὶ . . . δυνήσονται: For Apollod.’s ἀπὸ δὲ τοῦ ὀρύγματος τοσοῦτον ὁ βαθύνων δύναται.

32 ἀπαρεμποδίστως: The Anon. Byz. adds.

32 Ἐγγύτερον: For Apollod.’s Ἐλασσον.

34 οἱ ὀρύσσοντες: The Anon. Byz. adds.

35–38 μικραὶ . . . βαλλόμενα: For Apollod.’s μικραὶ οὔσαι καὶ εὐμετάγωγοι ὧσι, μὴ πολὺ δὲ διεστηκυῖαι, ἵνα μὴ εὐθικτῆ τὰ ἐπιβαλλόμενα.

Chapter 14. Supporting the Excavation.

Burning the Supports to Cause the Collapse.

The Anon. Byz. draws here on Apollod. 145:1–146:3. For a description of excavating through (rather than under) a wall, see Eustathios, *La espugnazione di Thessalonica*, ed. S. Kyriakides (Palermo, 1961), and *The Capture of Thessaloniki*, trans. J. R. M. Jones (Canberra, 1988), 96:1ff. For examples of the use of props that are subsequently burned (although under rather than in the wall), see Leo diac. 25:11–26:8, Nikephoros Ouranos, *Taktika* 65:117–39, and Anna Comnena, *Alexiad* XI:1.

2 **διάχωρα**: For Apollod.'s ζωθήκας (LSJ: “niche in a wall”). On the latter term, more common in Latin authors, see G. Hermansen, *Ostia: Aspects of Roman City Life* (Alberta, 1981), 23–24.

4 **ἀπαρεμποδίστως**: The Anon. Byz adds.

8 **ὑποστυλούσθω . . . στυλαρίοις**: For Apollod.'s στυλώμασιν ἐρειδέσθω.

10–11 **ὑποχαλῶντα τὰ στυλάρια**: For Apollod.'s ἐνδάκη ὁ στῦλος.

13 **ξύλων ξηρῶν ἐσχισμένων**: For Apollod.'s σχίδακες.

14 **δάδων**: The term is from Apollod. here and below at **19:18**; see André, “Résine,” 87 (“le “bois gras” (δῶς) . . . tissu du pin gonflés de résine”), and on pine wood see Dunn, “Exploitation,” esp. 259.

16 **ξύσματα ξύλων ξηρὰ . . . ἐπαλιφέντα**: For Apollod.'s ξύσματα ξύλων τεθειωμένα (< . . .) περιεσπαρμένα, the lacuna in Apollod. posited by Schneider. Schneider, *Apollodoros*, 17, note on Apollod. 145:12, takes Apollod.'s πυροβόλα in this instance to be not fire-arrows but πυρεῖα (“Feuerzeuge”), an interpretation he sees as confirmed by the Anon. Byz.'s additions here. See also below, **19:9–10**. On the Anon. Byz.'s use of τὸ πυροβόλον generically see above on **2:9**. For the form ἐπαλιφέντα see also below, **19:10** and cf. Athanasius, *Vita Antonii*, PG 26 col. 965:29, ἐπαλιφείς.

17 **ὑγρᾶ πίσση**: Presumably added by the Anon. Byz., although the source, Apollod., may have a lacuna at this point; see also below at **19:9–10**. For liquid pitch see *De aet.* 673:3 and 677:11: πίσσα λίτραι χιλιάδες ἰ΄. ὑγροπίσσιον μαγαρικὰ στρογγύλα τ΄, and as one of the materials to be obtained in preparation for withstanding a siege, *De obsid.* 48:19, πίσσαν ὑγρὰν καὶ ξηρὰν. For discussion see πίσσα ὑγρὰ, André, “Résine,” 95, and on pitch generally, Meiggs, *Trees*, 467–71, and *RE* XIX at “Pech.” On the requisitioning of pitch for the Cretan expedition see Dunn, “Exploitation,” 268–69. See also below **15:10** and **19:10**.

Chapter 15. Protective Coverings for Tortoises

The Anon. Byz. here draws on Apollod. 146:4–147:6 with significant changes in the sequence of presentation.

2 **δακτύλων ὀκτώ**: For Apollod.'s ἡμιποδιαῖοι.

2 **καρφία**: The Anon. Byz. adds. Cf. Leo, *Taktika* VI:26: ἦλοις καθηλοῦσθαι . . . ἦγουν καρφίοις. The term is used frequently in the inventory for the Cretan expedition in the *De cer* (672:12–14) with various descriptive adjectives, and for use with tortoises see *De cer* 658:22–659:1: περὶ τοῦ ἐτοιμασθῆναι καρφίον ἀρπάγιον κοινοστομαῖον λόγῳ χελωνῶν.

3–4 **ἄχρι . . . ἐχέτωσαν**: For Apollod.'s more general μὴ ὅλοι ὥστε ὑπερεστάναι.

5 **πηλὸν λιπαρόν**: For Apollod.'s λιπαρῶ γῆ. The Anon. Byz. recommends the same coating against fissures at **24:4**, **39:18–19**, **40:4** and **47:13**.; Apollod. uses it again at 156:4 and 173:17. The Anon. Byz. is more elaborate and specific in adding κολλῶδα, χοιρείων and τραγείων (see **15:5–6**). Cf. Leo, *Taktika*, Appendix, 54 (PG 1117B): αἱ δὲ χελῶναι πηλῶ διαχρίσθωσαν ἄνωθεν. See also Lendle, *Texte*, 100 n. 117.

5–6 **μετὰ τριχῶν χοιρείων ἢ τραγείων**: The Anon. Byz. adds here; cf. Apollod. 156:4: γῆν . . . λιπαρὰν μεμαλαγμένην . . . τριχῶν αὐτῆ μιγείσῶν.

6–7 **ἵνα . . . διασχίζηται**: The Anon. Byz. adds here (cf. Apollod. 157:1: ἵνα τηρήσωσιν ἀρραγάδωτον).

7 **Κρατηθήσεται**: For Apollod.'s κατασχεθήσεται.

9 **Ῥάκη**: See above on **13:21**.

10 **ἄμμος θερμὴ . . . πίσσα . . . ἔλαιον**: The three substances are mentioned by Apollod. For molten pitch (πίσσαν διαλυθεῖσαν πυρὶ) used against tortoises see (Περὶ Στρατηγίας)13:65; for pitch and oil, see Leo, *Taktika*, Appendix, 53 (PG 1116B).

10 **τῆλι ἀφεψηθεῖσα**: The Anon. Byz. adds. Schneider suggested (84) that the Anon. Byz. has taken the military use of fenugreek from Josephus, *Bellum Judaicum* III:277:2: τὰς προσβάσεις αὐτῶν ἐπέσφαλλον τῆλιν ἐφθῆν ἐπιχέοντες ταῖς σανίσιν, ἧς ἐπολισθάνοντες ὑπεσύροντο, as the preceding passage of Josephus (ibid., III:274:2–4) contains a reference to boiling oil (ζέον ἔλαιον) being poured from the walls on the Roman besiegers and the comment καὶ τὴν σάρκα φλογὸς οὐδὲν ἔλασσον ἐπεβόσκετο, θερμαινόμενόν τε φύσει ταχέως καὶ ψυχόμενον βραδέως διὰ

τὴν πιότητα. The use of fenugreek in Josephus, however, is to cause the besiegers to slip and fall on their gangways, not to burn their flesh. Leo, *Taktika*, Appendix, 53 (PG 1116B), has πίσσα καὶ ἔλαιον καὶ τῆλις ζέοντα πάντα καὶ ταῖς εἰρημέναις προσχεόμενα κλίμαξι; thus the Anon. Byz. may be reflecting contemporary practice. For a useful collection of references to fenugreek in antiquity (*Trigonella Foenum-graecum*, a genus of leguminous herbs from which about 6% fatty oil can be extracted) see *RE* III:580–82 at *Bockshornklee*.

11–12 ὡς ταχέως . . . βραδέως: See above on **15:10**, τήλη.

12–13 παρομοίως . . . σάρκας: See above on **15:10**, τήλη.

15 πυροφόρων: See above on **2:9**.

16 ἀναπτομένων φλογῶν: See above on **2:9**.

17–19 Ὡσαύτως . . . ἀντιμάχεσθαι: The Anon. Byz. adds.

18–19 δέρμασι . . . νεοσφαγῶν: The references to *laisai* and wicker tortoises and this type of protective coating are added here by the Anon. Byz. For the same use of hides see also below, **17:4**, **40:4–5** and **47:14**. Apollod. (142:1, 146:4, 173:14, 189:11) mentions simply δέρρεις, and once δέρρεις τρίχιναι as protection for various siege machines, while Ath. Mech. (12:11, 18:3, 24:8) uses the phrase ἀγραῖς βύρσαις. For military use of untanned hides see Dar.-Sag., *Dictionnaire*, IV:1:371–72 (*pelles*) and *RE* XIX:369–73 (*pellis*). For Byzantine parallels see *Miracula Demetria* 148:28–31 τὰς καλουμένας χελώνας, ἄστινας σὺν τοῖς πετροβόλοις δέρρεσιν ἐπισκεπάσαντες ξηραῖς, μεταβουλευσάμενοι πάλιν διὰ τὸ μὴ ὑπὸ πυρὸς ἢ πίσεως καχλαζούσης ἀδικεῖσθαι, δέρρεις νεοσφαγῶν βοῶν καὶ καμήλων ἠμαγμένας ἔτι τοῖς ὀργάνοις ἐκείνοις ἐνήλωσαν, and Leo, *Taktika* XV:30: Εἰσὶ δὲ καὶ πύργοι ἀπὸ ξύλων συγκείμενοι, καὶ διὰ βυρσῶν ἢ ἐτέρας ὕλης ἐπισκεπόμενοι, ὥστε διὰ πυρὸς μὴ φθειρέσθαι; and Appendix, 54: ξύλινοι πύργοι βύρσαις νεοδόρων βοῶν περιφραγκίσθωσαν.

18 διαβρόχοις: Leo, *Taktika*, Appendix, 54 recommends that tortoises be covered on top with clay and that σπόγγοι δὲ ὄξει διάβροχοι ταύταις ἐπιτιθέσθωσαν ἔξωθεν (ἀποτρέποι γὰρ ἂν τὸ ὄξος τὴν τοῦ πυρὸς ἐρωήν). See also below, **50:27**.

20 πόρρωθεν . . . τοξοβολιστρῶν: For Apollod.'s μακρόθεν βέλους.

The λιθοβόλος is found in Apollod. (188:6) and Ath. Mech. (18:6), the τοξοβολίστρα is a later term, not found in the classical sources. Cf. Theoph., I:384:11; *De aet.* 670:11 (τοξοβολίστραι μεγάλοι) and 671:16 (μικρὰς τοξοβολίστρας), etc.; Leo, *Taktika* VI:27, where the device with arrows is said to fit in a wagon (Ἐτέρας ἀμάξας ἐχούσας τοξοβολίστρας καὶ σαγίττας αὐτῶν), and *ibid.*, V:7. On the term see Koliass, *Waffen*, 244–45. The Anon. Byz. uses λιθοβόλος at **27:84**, **39:35**, **44:38** and **45:4**.

Chapter 16. Bellows-Driven “Flame Thrower”

The Anon. Byz. draws here on Apollodorus 152:7–153:7; on the impracticality of the device, which is illustrated on folio 13r, see Blyth, “Apollodorus,” 140. For a similar device see Thucydides IV.100 (an αὐλός, a λέβης filled with charcoal, sulphur, and pitch, and with an iron ἀκροφύσιον, and a bellows). Polybius XXI:28:12–13 (followed by *De obsid.* 76:22ff) describes a related approach to smoking out sappers; the latter device is also found in Leo, *Taktika*, Appendix, 53 (PG 1116C). See also below, **19:26–29**.

2 προσεγγίζοντα κάτωθεν: The Anon. Byz. adds.

3 καὶ ἐπισφαλές: The Anon. Byz. adds.

5 φορά : For Apollod.’s ἐπέρεις.

5–6 ὡς φύσει . . . τυγχάνουσα: For Apollod.’s ἀνωφεροῦς ὄντος. Cf. Aristotle, *Physica* 230b: φέρεται δὲ τὴν μὲν ἄνω φορὰν φύσει τὸ πῦρ. Anna Comnena, *Alexiad* XI:10:4:18 also cites the same passage from Aristotle regarding shooting “Greek fire” horizontally.

7 ἐπὶ . . . ὀρμῇ: The Anon. Byz. adds.

7 οἱ ἔνδον ἐργαζόμενοι: For Apollod.’s οἱ ταῦτα ποιοῦντες.

8 συγκαήσονται: For Apollod.’s συγκαήσεται.

8–9 κύθρινοι ὀστράκινοι: The phrase is from Apollod. The container illustrated on folio 13r is labeled (χ)ύτρινος.

9 πετάλων: For Apollod.’s λεπίσσι, as in **16:11** and **17:10**.

9 ἐπὶ τοῦ ἔξωθεν μέρους: The Anon. Byz. adds.

10 γεμίζονται: For Apollod.’s πίμπλονται.

10–11 ἀπό δὲ τῆς ἔξωθεν ὄψεως: The Anon. Byz. adds.

13 ἀυλίσκον: For Apollod.'s σύριγγα. See also below, **19:29**.

15 ὁμοίαν φλογὸς ἀπεργάζονται ἔκκαυσιν: For Apollod.'s πληγὴν ὁμοίαν ἐργάζεται φλογί. Cf. Aristotle, *Problemata* 936a: ἡ δὲ φλόξ καὶ τὸ ἀπὸ τῶν ἀνθράκων διὰ λεπτότητα εἰσιὸν διαλύει. On the passage of Apollod. see Partington, *History*, 2.

16 ὄξους: The technique is in Apollod. The *locus classicus* is Hannibal (Livy, 21:37); for Byzantine examples see <Περὶ Στρατηγίας> 18:53–56, with n. 1.

16 οὔρου: The Anon. Byz. adds.

17 Καὶ . . . ὑπογέγραπται: Cf. Biton, 56:6–7, 61:1, 64:2–3, and 67:3–4: τὸ δὲ σχῆμα οἷόν ἐστιν ὑπογέγραπται.

18 μολιβδουργοί: The reference is in Apollod.; on the methods of lead workers, including blowpipe and bellows, see R. J. Forbes, *Studies in Technology*, VIII (Leiden, 1971), 114–19, and J. O. Nriagu, *Lead and Lead Poisoning in Antiquity* (New York, 1983), 84–91.

Chapter 17. Bow-Drill Used to Bring Down Walls

The Anon. Byz. draws here on Apollod. 148:2–150:3. For discussion of the device, the “Handmauerbohrer,” see Lendle, *Texte*, 147–50, and for its impracticality Blyth, “Apollodorus,” 140. It is illustrated on folios 14r (with the ἀρίς and the πυελίς labeled) and 14v (on which the handspikes are clearly shown).

2 τρυπάνων: The term is from Apollod. See also above, **11:17**, and below, **30:3**, for different uses of the word, and Winter, *Fortifications*, 72 n. 8. Bryer, “Implements,” 79, shows the smaller Byzantine auger (τρυπάνιον).

2–6 ὑπὸ χελωνῶν . . . ὑγρά: The Anon. Byz. adds here. See above, **15:10**.

7 τεκτονικοῖς ὄργάνοις: The Anon. Byz. adds. See Lendle, *Texte*, 150 n. 166, for the validity of the simile and Roman industrial uses of such tools.

8 ποδῶν . . . πέντε: The text of Apollod. indicates that he sees the

entire device as 5 feet long. For discussion of the difference see Lendle, *Texte*, 148.

8–9 δακτυλιαίαν τὴν διάμετρον . . . πάχος γυρόθεν ὡσεὶ δακτύλων τεσσάρων: For Apollod.'s δακτυλιαῖοι τὸ πάχος. The Anon. Byz. here adds the latter dimension using a rough approximation (i.e., 4 for π) for the relation between diameter and circumference, that is, $C = 2\pi r$.

10 πέταλον: For Apollod.'s λεπίς.

11–12 πλάτους . . . ὀκτώ: Schneider argued (*ad loc.*) that a blade 12 fingers wide is incompatible with a shaft 1 finger in diameter. Lendle, *Texte*, 149, notes that the bore holes, according to Apollod. (150:6–151:3), are filled with stakes nearly 3 fingers thick (there are multiple stakes in each bore hole); therefore, a wide blade would be needed to create such holes, justifying the Anon. Byz.'s comparison of it to a garden spade.

12–13 ἐστενωμένον . . . πλατυλισγίου: For Apollod.'s οὐραχὸν μέσον ἔχουσα.

13 πλατυλισγίου: Cf. *De aer.* 463:1: ἀξινορύγια καὶ πλατυλίσκια καὶ πτυάρια στιβαρά (“pick-axes and broad spades and heavy shovels”), on which Reiske, *De aer.* II:508 n. 463:1, says “nos appellamus *Spathen*.” The precise shape of the tool is uncertain. For λίσγον see A. Harvey, *Economic Expansion in the Byzantine Empire, 900–1200* (Cambridge, 1989), 124, and M. Kaplan, *Les hommes et la terre à Byzance* (Paris, 1992), 48 n. 210 and 275; for λισγάριον Bryer, “Implements,” 1070–73. See also Souda Σ542· Σκαφείδιον· τὸ λισγάριον.

14 ἀπὸ τόνου: The Anon. Byz. adds. The term does not appear in Apollod. or Ath. Mech. (see, however, τετορνευμένοι at Ath. Mech. 23:7). See below on **44:25**.

16 κεφαλοιδη παρεξοχήν: For Apollod.'s ἄλλον οὐραχόν. The noun παρεξοχή and the verb παρεξέχειν each occur five times in the *Parangelmata*. *LSJRS*, s.v., gives on the former “wd. of uncertain meaning.” Both appear to be used generically to refer to projecting parts of various structures (see, e.g., **31:6**), and I have so translated.

17 ἐπικεφαλίδα: The Anon. Byz. adds. For the term see Demetrakos, *Lexikon*, s.v., and *LSJRS*, s.v. “perh. *bearing* or *axle-box*.”

21 **κανόνια**: The rods are depicted on folio 14v.

22 **ὡς φρεατίας . . . διεκβληθέντα**: The Anon. Byz. adds the simile. Lacoste, “Poliorcétiques,” 244 n. 1, comments: “Cette disposition était identique à celle de nos cabestans, ou de nos treuils de haquet.” On ἡλακάτη see *Scholia in Thucydidem* 7:25, ὤνευον (“they drew up with windlasses”): μηχανὴ ἐπ’ ἄκρων τῶν ἀκατίων πηγνυμένη, ἀφ’ ἧς περιβάλλοντες βρόχοις τοὺς σταυροὺς ῥαδίως ἐκ τοῦ βυθοῦ ἀνέσπων· ἔστι γὰρ ἡ μηχανὴ ἐπὶ τοσοῦτον βιαιοτάτη, ὥστε καὶ σαγήνην βαρεῖαν ὑπὸ δύο ἀνδρῶν ἀπόνως ἔλκεσθαι. καλοῦσι δὲ τὴν μηχανὴν οἱ τοὺς χαμαιλίχοντας ἔλκοντες ἀλιεῖς ἡλακάτην. ἐρρωμενέστερον δὲ πρὸς τὴν ἀνέλκυσιν καθίσταται, ὅταν καὶ δίκρουν ξύλον πρὸ αὐτῆς τεθείη· ἐπ’ εὐθείας γὰρ ἡ ἀντίσπασις τῶν ἀνελκομένων γίνεται. On the windlass with handspikes see Drachmann, *Technology*, 50ff (translating and commenting on the description of Heron, *Mechanics* II:1); Landels, *Engineering*, 10 and 85; and D. Hill, *History of Engineering in Classical and Medieval Times* (La Salle, Ill., 1984), 128. On Byzantine wells and water drawing devices see Koukoules, *Bios*, V:271.

26 **εὐκατάφορα**: For Apollod.’s εὐόλισθος.

27 **τὸ . . . πέταλον**: For Apollod.’s ὁ γνῶμων τοῦ τρυπάνου.

30–31 **ἀνωφερῆς σύντρησις**: For Apollod.’s κλίσις.

32 **παρεγκεκλιμένην . . . καταφοράν**: For Apollod.’s ὄλισθον.

33 **κλίσεως**: The term is from Apollod. Lammert, “Apollodoros,” 311, argues, against Schneider’s translation of Apollod. (“Das Bild zeigt, wie der Zusammenbruch aussieht”), “κλίσις ist vielmehr die vorher besprochene Schräge im Ansatz des Bohrers und dadurch der gebohrten Löcher.” The illustration on folio 14v shows the borer at an upward angle, but no break or collapse of the wall.

Chapter 18. Positioning of Bore Holes

The Anon. Byz. draws here on Apollod. 150:4–5, adding his own comments on measurement units.

2 **πόδα καὶ τέταρτον**: On the distance see Lendle, *Texte*, 147 n. 163.

4 **σπιθαμὴ . . . τεσσάρων**: The Anon. Byz. adds; see the Introduction, 23.

5 ἀπαρχομένους ποιείσθαι· Wescher added δεῖ to the text of the *Parangelmata* (including this case) in seven instances, Vincent to the *Geodesia* in two. In all these cases the δεῖ is also lacking in the archetype. An anonymous reader reasonably suggests that the frequent omission is unlikely to be due to scribal error. I have allowed the text of the archetype to stand in six of these cases as ellipsis of δεῖ. On the usage see R. Funk, *A Greek Grammar of the New Testament and Other Early Christian Literature* (Chicago, 1961), 196–97.

Chapter 19. Filling the Bore Holes with Rounded Stakes That Are Set Alight.

The Anon. Byz. draws here on Apollod. 150:6–152:4

2 ἀναγεμίζονται: For Apollod.'s πληρούσθω.

2 ἐκ τῆς ἔξωθεν . . . ἔνδον: The Anon. Byz. adds.

3–4 ξύλοις ξηροῖς ἐσχισμένοις: For Apollod.'s σχίδαξι. See above, **14:16**. Cf. Anna Comnena, *Alexiad* IV:4:6: νάφθαν καὶ πίσσαν καὶ ξηρῶν ξύλων σχίδακας.

4 κατὰ πλάτος: For Apollod.'s τὰς πλατύτητας.

5 πασσάλοις: The Anon. Byz. omits Apollod.'s σφηνῶν τρόπον εἰσαγομένους.

6 πρὸς τὴν βάσιν: The Anon. Byz. adds.

6–7 πρὸς . . . ἐστενωμένοις: The Anon. Byz. adds, apparently explaining Apollod.'s σφηνῶν (see above on **19:5**). For this tapering of the stakes see also below, **19:23**.

7–8 κατὰ . . . καιρόν: The Anon. Byz. adds.

9–10 ξύλα . . . ἐπαλιφέντα: For Apollod.'s (ξύλα) ξηρὰ ἢ τεθειωμένα ἢ πεπισσωμένα.

11 διαλείμματα: For Apollod.'s διάστημα. The term occurs frequently in the *Sylloge tacticorum* for the intervals between infantry units in formation. See also below on **25:8–9**.

12–13 ἔνθα . . . σβεννύηται: The Anon. Byz. adds.

15–16 κατὰ μέσον . . . διάχωρα: For Apollod.'s τὰ μεταξύ αὐτῶν χωρία.

16 κατὰ τάξιν . . . πρότερα: The Anon. Byz. adds.

18 ἵνα . . . σύντηρησις: On the nature of the joint channeling see Lendle, *Texte*, 147 n. 163: “Dank der Richtungsänderung der zweiten Bohrserie trafen nun jeweils zwei Bohrlöcher (wohl in etwa 2–3 Fuss Mauertiefe) V-förmig aufeinander und bildeten für die spätere Entzündung des Füllmaterials eine Einheit.”

18 πρότερα . . . ὑστέρων: The Anon. Byz. adds.

19–20 πελεκημάτων ἢ ῥυκανισμάτων: The Anon. Byz. adds. On the πέλεκυς see Bryer, “Implements,” 73–74, “double-bladed hatchet”; on the latter term, which is not in the *TLG*, see Demetrakos, *Lexikon*, s.v., and cf. Biton, 54:2: οὐ γὰρ χρεία ἐπὶ τῶν τοιούτων ἔργων ῥυκανήσεως ἢ λεπτοουργίας and *Anthologia graeca* VI.204–6: καὶ πέλεκυν ῥυκάναν τ' εὐαυγέα.

21 ἐπιδρασσόμενον . . . ποιείται: For Apollod.'s ἐπιβάλλεται.

23 κατὰ τὸ ὄλον ὕψος: The Anon. Byz. adds.

23 μείζονες εἰσι κάτωθεν: For Apollod.'s ἔχουσι . . . προβολήν.

24 ἀνέμου ἐμπνέοντος: For Apollod.'s ὑπὸ ἀνέμου.

24 ἐπανάπτεσθαι: For Apollod.'s ἐρεθίζεσθαι.

24–25 Εἰ δὲ νηεμία . . . εἴη: For Apollod.'s εἰ δὲ μή.

27 ἰξενταί: The comparison here, and below (39:26–27) of hollowed reeds used to convey water to put out a fire, is drawn from Apollod. (152:2, 174:6). The comparison extends only to the hollow reeds. On the use of such extendible lime-rods in bird-catching see J. K. Anderson, *Hunting in the Ancient World* (Berkeley, Calif., 1985), 146–47, with mosaic illustrations from the Piazza Armerina, and K. Lindner, *Beiträge zu Vogelfang und Falknerei im Altertum* (Berlin, 1973), esp. 95, on Apollod. On Byzantine uses of ἰξόβεργαι see Koukoules, *Bios*, V:399.

27 χαλκικοῖς: The Anon. Byz. adds. The device is illustrated on folio 15v. For illustrations of the bellows with blowpipe in the text of Apollod. see Schneider, *Apollodoros*, pl. 3. A similar bellows with blowpipe is illus-

trated on folio 13r; see also on **16:18**.

29 **αὐλίσκον**: For Apollod.'s σύριγγα.

Chapter 20. Use of Rams against Already Weakened Walls

The Anon. Byz. apparently draws here in part on phrases in Apollod. 157:7–9 and 158:1 (on the differences between brick and stone), but the notion of using rams against already weakened brick walls is not in the extant classical sources. On the difficulty of using rams against brick see Winter, *Fortifications*, 71–72.

3 **τῷ συμπάχῳ**: On the term, found also below at **27:1** and **36:6**, cf. George the Monk, *Chronicon*, ed. C. de Boor, 2 vols. (Leipzig, 1904; repr. Stuttgart, 1978, with corrections by P. Wirth), 189:18: λίθους ἀκροτόμους καὶ ἀπελεκήτους ἤτοι ἀδαμαντίους καὶ παμμεγέθεις λίαν εἰς τὰ θεμέλια θέμενος ἔχοντα πήχεις ἰ' τὸ σύμπαχον, and see Demetrakos, *Lexikon*, s.v: ὁ παχύς, πυκνὸς τὴν σύστασιν, συμπαγῆς, ὅθεν τὸ οὐδέτερον ὡς οὐσιαστικὸν τὸ σύμπαχον — ἡ συμπαγῆς σύστασις.

4 **τεχνουργήματι**: On the term cf. Theo. Sim., II:16:11: διδάξας τοὺς βαρβάρους πρὸς πολιορκίαν τεχνούργημα, Leo diac., 25:13–14: κριὸν Ῥωμαῖοι τὸ τεχνούργημα ὀνομάζουσι, and Souda, Delta 1195:1: Διόπτρα· μηχανικὸν τεχνούργημα.

6 **λακκίζουσα**: See on **11:7**.

10 **κερατίσεις**: The term is attested in Achmetis, *Oneirocriticon*, ed. F. Drexel (Leipzig, 1925), 214:10: ἀναλόγως τῆς κερατίσεως.

Chapter 21. Second Table of Contents

This brief transition passage is basically the Anon. Byz.'s own, but perhaps with reference to Apollod. 159:3 (συμβολαί) and 161:7 (μονοξύλους). For composite rams see Apollod. 159:2–161:8. Schneider (33 note) makes the plausible suggestion that a portion of the text may be lost here.

3 **ἄρτήσεις**: The term is not found in the Anon. Byz.'s classical sources; Apollod. does regularly use ἄρτημα, which the Anon. Byz. changes to βάσταγμα. See below on **25:9**.

5 διαβάθρας: See above on 2:11.

Chapter 22. Ram Tortoise of Apollodorus

The Anon. Byz. draws here on Apollod. 153:8–156:2. For detailed discussion of the device see Lendle, *Schildkröten*, 103–21; for discrepancies in the text of Apollod. caused by likely interpolations, see Blyth, “Apollodorus,” 135 and nn. 21–23. The device is illustrated on folio 18r.

1 πόρτας: The Latin term replacing Apollod.’s πύργον ἢ πύλιν. Cf. Leo, *Taktika* XV:4: παρὰ τὰς πόρτας, ἢ εἰς τὰ παραπόρτια τῆς πόλεως; and Nikephoros Phokas, *Praecepta militaria* VI:1: κρατηθῆναι δὲ καὶ τὰς πόρτας τοῦ μὴ ἐξέρχεσθαί τινα.

2 ῥηγνύειν καὶ διασπᾶν: For Apollod.’s σεῖσαι.

3–4 ἄνωθεν . . . ἀνέχοντα: For Apollod.’s αἰ τὸ ἄρτημα τοῦ κριοῦ φέρουσιν.

4–5 ἀφ’ ὑψηλοῦ . . . βασταζόμενος: For Apollod.’s ὑψηλοῦ . . . ὄντος τοῦ ἀρτήματος; cf. below on 25:8–9.

6 πρὸς τὴν κίνησιν: The Anon. Byz. adds.

7 ἐνδυναμοῦται καὶ προσκρούων τῷ τείχει: The Anon. Byz. adds.

8 καὶ ἰσχυράν: The Anon. Byz. adds.

10 εὐπαράγωγος: For Apollod.’s εὐάγωγος.

10–11 τὸ δὲ μῆκος . . . ἔλασσον: The Anon. Byz. adds. See Lendle, *Schildkröten*, 110: “Der Anonymus Byzantinus schlägt an der eben zitierten Stelle 24 Fuss (= 7,09 m), kurz davor (225:17) gleiche oder ein wenig kürzere Länge als Höhe . . . vor, was der Sache nach wohl zutreffend sein dürfte.”

11–12 ἵνα . . . εἴη: For Apollod.’s ἵνα ὀξεῖαν τὴν ῥάχιν ἔχη, καὶ τὰς πλατύτητας παρορθίους.

11 ὀξύρρυτος: Cf. δίρρυτος at 13:5.

13 παρεκτρέχη: For Apollod.’s παρολισθαίνη.

13 Ζυγά: For discussion of the use of the term in Apollod., see Lendle, *Schildkröten*, 108.

13–14 **καὶ δύο**: The Anon. Byz. adds here and interprets as pairs of beams Apollod.'s ζυγὰ δύο, an interpretation visible in the illustration on folio 18r; both Schneider and Sackur, *Vitruv*, also interpreted Apollod.'s phrase as “Balkenpaare,” but for doubts see Lendle, *Schildkröten*, 107–10.

18–19 **ὀκτώ . . . ἐφιστάμενα**: The Anon. Byz. here interprets Apollod.'s κατὰ τὸν ἀριθμὸν δ'.

19 **συννεύοντα**: The Anon. Byz. adds.

22 **παρεξέχον . . . αἰτίας**: The Anon. Byz. adds.

22–23 **καθ' ὃ . . . προσνεύειν**: Lendle, *Schildkröten*, 108 n. 121 with illustration and 120, argues that the clause is better taken with what precedes, since the μέσα ζυγά mentioned in what follows here are apparently attached to all the uprights, not just those at the front of the tortoise where the roof is extended.

23 **προσνεύειν**: An extension of the roof (προστεγάσμα) gives added protection to the front end of the ram as it strikes the wall. For reproductions of illustrations of this extension in the manuscripts of Apollod. see Lendle, *Schildkröten*, 104–5. The extension and projecting ridge-pole are visible on folio 18r.

24 **ὀρθοστάτας**: That is, the eight beams (ξύλα . . . συννεύοντα) that encompass the ridge-pole. Below (22:49) they are referred to as παρορθίων.

24 **τούτοις**: That is, the ὀρθοστάται.

25 **παραστάται**: The term is from Apollod.; see Lacoste, “Poliorcétiques,” 240 n. 1, who comments that amid a variety of uses there is a core sense of “des pièces de renfort, placées contre d'autres pièces.”

25–26 **ἀντέχοντες καὶ στηρίζοντες**: For Apollod.'s ἐρείδοντες.

26 **τὰ μέσα ζυγά**: See commentary on 22:22–23.

28–30 **Ἄπὸ . . . οὔσι**: For discussion of this difficult sentence, particularly the reading τὰ ἔσω, see Lendle, *Schildkröten*, 111–13 (and illustration, 121). See also the suggestion of Lacoste, “Poliorcétiques,” 250 n. 1: “Il y a une erreur évidente dans les mss. où on lit: τῶν ἔσω ζυγῶν, au

lieu de τῶν κάτω ζυγῶν: il s'agit ici de fourrures destinées à protéger les côtes de la machine, dans la partie correspondante à la hauteur des roues.”

30 ἀκλινέσι: The Anon. Byz. adds.

31 τουτέστι τὸ διάστημα: The Anon. Byz. adds.

32 ἀντέχοντας καί: The Anon. Byz. adds.

32–33 τὸ ὄλον . . . σύμπηγμα: The Anon. Byz. adds.

33–34 περιτομίδας . . . χελωνίων: On the method of securing the beams, which is taken from Apollod., see Lendle, *Schildkröten*, 111–21, *Texte*, 79; and Sackur, *Vitruv*, 36–38.

33 περιτομίδας: The term is from Apollod.; for its likely meaning see Lendle, *Texte*, 79: “Unter περιτομίδες sind offenbar winkelig geschnittene Streben zu verstehen.” It is to be distinguished from the περιστομίδας at **44:31**.

34 οὐκ ἔξω τομῆς γινομένης: The phrase is from Apollod.; see Lendle, *Schildkröten*, 111, who translates “wobei kein Schnittende (dieser ‘Schnittbalken’) ausserhalb (der Verbretterung der Maschine) gerät,” with discussion at 114–16.

34 χελωνίων: The term is from Apollod. Lendle, *Schildkröten*, 115, renders “Knaggen”; see below on **22:35–37**.

35–37 ὡσανεὶ . . . τιθεμένοις: The Anon. Byz. adds. The same simile for the χελώνια occurs again below at **31:16–19** and **44:11–14** (as χελωνάρια). Lendle, *Schildkröten*, 112 n. 126, following Sackur, *Vitruv*, 27 n. 1, comments “Dass Eisenbeschläge nach der Art von Türpfannen (die wegen ihren gewölbten Formen zu Recht χελώνια genannt werden konnten) hier nicht gemeint sind.” The Anon. Byz.’s interpretation seems to require a translation in the sense of “caps.” On pivot sockets lined with bronze inserts in Hellenistic gates see Winter, *Fortifications*, 258.

35 γρονθαρίων: The term appears as a gloss for χελώνια in manuscripts of Apollod.; see Wescher, 178 n. 4. Sophocles, *Lexikon*, citing this use, s.v., gives: “Latin *subgrunda* = γεῖσον”; see also LSJ, s.v. Perhaps the term is used for the portion of a cornice hollowed out to receive a door pivot. Trapp, *Lexikon*, s.v., gives “(kleine) Faust.”

38 ὄξυρρότου: The Anon. Byz. adds.

38–50 **Γίνεται . . . τείχους**: This section on a lower tortoise with rafters is not found in Apollod. and is apparently the Anon. Byz.'s own addition, influenced in part by Ath. Mech.'s description of Hegetor's ram tortoise, 22:6–9: Ἐπὶ δὲ τῶν ἐπιστυλίων πῆγγνυται συγκύπται . . . καὶ ἐπ' αὐτῶν δοκὸς ἐμπῆγγνυται πλαγία εἰς ἣν πᾶσαι αἱ κορυφαὶ τῶν συγκυπτῶν πῆγγνυται, καὶ γίνονται δύο πλευραὶ κεκλιμέναι.

41 **συγκύπται**: The term occurs in Ath. Mech.'s description of the χωστρίς χελώνη (18:10), where it is equated with συστάται, and in his description of the ram-tortoise of Hegetor. For discussion of its function and form see Lendle, *Schildkröten*, 27 (who translates as “Dachsparren”); Rochas D'Aiglun, “Athénée,” 790, renders with “chevrons.”

41 **ἀετώματος**: ἀετός is found at Ath. Mech. 13:5 and ἀέτωσις at Ath. Mech. 13:3–4. For this form see Souda, Alpha 576:1–2: Ἄετὸς τῶν οἰκοδομημάτων τὸ κατὰ τὸν ὄροφον, ὃ τινες ἀέτωμα καλοῦσιν.

48–49 **τῶν προειρημένων παρορθίων μονοξύλων**: A reference to the sloping beams of the tortoise which are referred to above as ξύλα . . . συννεύοντα.

50–56 ἴνα . . . **διαφθερεῖ**: The Anon. Byz. here paraphrases Apollod. 154:6–11.

52–53 **μέγιστοι λίθοι**: See above on 2:8–9.

53 **ἰσοβαρῶς καὶ ἰσοζύγως**: The Anon. Byz. adds. For beams on chains dropped on rams cf. Thucydides, II:76 (siege of Plataea): καὶ δοκὸς μεγάλας ἀρτήσαντες ἀλύσει μακραῖς σιδηραῖς ἀπὸ τῆς τομῆς ἐκατέρωθεν ἀπὸ κεραιῶν δύο ἐπικεκλιμένων καὶ ὑπερτείνουσῶν ὑπὲρ τοῦ τείχους ἀνελκύσαντες ἐγκαρσίας, ὅποτε προσπεσεῖσθαί πη μέλλοι ἢ μηχανή, ἀφίεσαν τὴν δοκὸν χαλαραῖς ταῖς ἀλύσει καὶ οὐ διὰ χειρὸς ἔχοντες, ἢ δὲ ῥύμη ἐμπίπτουσα ἀπεκαύλιζε τὸ προὔχον τῆς ἐμβολῆς.

54 **ἀστέγαστον**: The Anon. Byz. adds.

57–58 ἢ **ἐμπροσθεν χελώνη . . . ἔχουσα**: For Apollod.'s ἢ μὲν τὸν ἰστὸν φέρουσα τοιαύτη.

57 **βασταγός**: Given Apollod.'s ἡ μὲν τὸν ἰστὸν φέρουσα τοιαύτη, presumably **βασταγή** refers to what is carried (see Hesychius, 309:1: **βασταγή**: βάρος, and Trapp, *Lexikon*, s.v., *Gepäck*), while **βάσταγμα** below at **25:9** and **40:13** refers to the suspension system. Barocius, however, renders both terms with *sustentacula* and Schneider with *Gehänge*.

58 ἡ . . . **δευτέρα**: The second tortoise is illustrated on folio 18r, the others are not. For discussion of Apollod.'s addition of them as a critique of Hellenistic practices, see Lendle, *Schildkröten*, 106–7.

61 ὡς **προείπομεν**: Said above (**13:35–38**) of the excavating tortoises.

61–62 **διὰ τὸ εὐκόπως προσάγεσθαι**: For Apollod.'s **διὰ τὸ εὐάγωγον καὶ εὐσύνθετον**.

63–64 **διὰ . . . παράγεσθαι**: For Apollod.'s **διὰ τὰ ἐναντία τούτοις ἐλαττώματα**. The Anon. Byz.'s **δυσευρέτων** (see also below [**32:1**] **δυσεύρετοί εἰσι**), a term not found in Apollod. or Ath. Mech., may suggest a somewhat greater concern with the availability of wood than his sources, although Apollod. (139:5) does recommend building machines **εὐπόριστα τῇ ὕλῃ** (see above, **2:15–19**).

64–65 **Τὰ . . . ὑπόκειται**: For Apollod.'s **Τὰ δὲ σχήματα καὶ τὰ ὄρθια καὶ τὰ κάτω γεγραμμένα παράκειται**. On Apollod.'s terminology see below, **27:92**.

Chapter 23. Ramming the Upper Parts of the Wall

The suggestion is added here by the Anon. Byz. The concept of attacking the upper parts of the walls may be derived from Apollod. 185:13–16 (a passage repeated by the Anon. Byz. at **40:12–16**), where rams on ladders are said to have a shorter front hanger to provide them an upward angle, thus giving access to the upper and hence less unified parts of the wall.

Chapter 24. Wheels for the Ram Tortoise

The Anon. Byz. draws here on Apollod. 156:3–158:1.

3 **προείρηται**: Cf. **15:1–3**, above.

4–5 **πηλοῦ . . . μεμαλαγμένου**: See above on **15:5**.

5 καὶ ἀδιασχίστου συντηρουμένου: For Apollod.'s ἵνα τηρήσωσιν ἀρραγάδωτον.

8 ὥστε . . . μέγεθος: For Apollod.'s οἱ βαστάζουσιν αὐτὴν εὐεδρον.

9–10 καὶ . . . οὐσαι: The Anon. Byz. adds.

11–12 ἀσφαλῶς . . . ἵσταμένην: For Apollod.'s εὐόλισθον.

13–15 Ὑποβάλλονται . . . παρακίνησιν: The Anon. Byz. adds.

18 τὸ χαῦνον: The Anon. Byz. adds.

20 λακκίζουσα: See above, 11:7.

22 < . . . >: Wescher (229:20) suggests that the lacuna contained, in part, material from Apollod. 158:2–161:8 on δέσεις κριῶν. See also Dain, *Tradition*, 30.

Chapter 25. Ram of Hegetor

The Anon. Byz. here draws on Ath. Mech. 21:1–26:5, but with significant changes of order, compressions and omissions; Hegetor's ram is also described by Vitruvius, X:15:2–7. Schneider, *Athenaios*, 61 n. 21:3, comments on the Anon. Byz.'s version: “Was ihm unverständlich war, hat er sich nach seiner Weise zurechtgelegt, oder auch weggelassen.” The Anon. Byz. perhaps also wishes to include briefly the largest known ram from antiquity and mentions its length first in his description. For discussion of the two earlier texts with references to the Anon. Byz., see Lendle, *Schildkröten*, 48–86, Callebat and Fleury, *Vitruve*, 263ff, and Fleury, *Mécanique*, 311–16. The device is illustrated on folio 20r; the drawing from Paris. suppl. gr. 607 illustrating the text of Ath. Mech., as well as various modern drawings, are reproduced in Lendle, *Schildkröten*, 49–52.

1 (Ὁ)ἰ . . . περί: Ath. Mech. has: Τῆς δὲ ὑπὸ Ἡγήτορος τοῦ Βυζαντίου ἠύρημένης χελώνης. The Anon. Byz.'s expression may simply be a periphrasis for Hegetor; on the usage as denoting either the school associated with the figure named or merely a circumlocution for the figure himself, see W. R. Knorr, *Textual Studies in Ancient and Medieval Geometry* (Boston, 1989), 25 n. 3, and R. Kühner and B. Gerth, *Ausführliche Grammatik der griechischen Sprache*, 3rd ed. (1898; repr. Hannover, 1966),

II:1, p. 269–71. See also below, **32:2**, **36:2**, **38:21** and **48:1**.

1 Ἠγήτορα: Known only from the related references in Ath. Mech. (21:2), Vitruvius (X:15:2), and here; he may have been associated with Demetrius Poliorceticus. See *RE* VI:104 (Hegetor, 2) and Callebat and Fleury, *Vitruve*, 263 n. 15.2.1.

2 πηχῶν ἑκατὸν εἴκοσι κατὰ μῆκος: This length is that given by Ath. Mech., while Vitruvius has 104 feet. For doubts about the possibility of a ram beam of 120 *pecheis* see Lendle, *Schildkröten*, 61–62, who suggests a corruption in the text of Ath. Mech. from 70 to 120 cubits; Fleury, *Mécanique*, 318–20, Meiggs, *Trees*, 168–69; and Callebat and Fleury, *Vitruve*, 263.

2 πτέρνης: On the term as “butt-end” see Landels, *Engineering*, 96 and 117, and Marsden, *Treatises*, 166 and 173.

3–5 εἰς δὲ πλάτος . . . τριπάλαιστον: Ath. Mech. (23:11–24:2) has ἐκ δὲ πτέρνης πάχος μὲν ποδῶν β', πλάτος δὲ ε' παλαιστῶν· εἰς ἄκρον δὲ συνήκται αὐτοῦ τὸ μὲν πάχος ποδιαῖον, τὸ δὲ πλάτος τριπαλαιστιαῖον. The Anon. Byz.'s dimensions are approximately the same as those given by Vitruvius; see Fleury, *Mécanique*, 319 n. 3.

5 ἔλικας: For an illustration of these protective iron bands (“eiserne Windungen”), see Lendle, *Schildkröten*, 63, who describes their function: “um das an der Spitze besonders gefährdete Holz vor Beschädigungen . . . zu schützen.”

7 τρισί: On the number see Lendle, *Schildkröten*, 63 n. 78.

7 σχοινίοις: For Ath. Mech.'s ὅπλοις. Vitruvius (X:15:6) makes clear that the ropes are placed along the entire length of the ram and bound by smaller wrappings; for discussion and illustration see Lendle, *Schildkröten*, 63–64.

7 κατὰ πάχος γυρόθεν: That is, “circumference,” the phrase added by the Anon. Byz.; see Schneider, *ad loc.*, and Lendle, *Schildkröten*, 64 n. 79.

8–9 ἀνελάμβανον . . . βασταγμάτων δὲ τεσσάρων: For Ath. Mech.'s καὶ διαλαμβάνεται κατὰ μέσον ἐκ τριῶν διαλημάτων ἀλύσει παχείαις. Διαλημάτων (LSJ, “windings of a chain”) is the reading of Paris. suppl. gr. 607; other manuscripts of Ath. Mech. have διαλειμμάτων, and pre-

sumably the Anon. Byz. had the latter reading. Rochas D'Aiglun, "Athénée," 792 n. 1, translates the text of the Anon. Byz.: "il le suspendait par le milieu par quatre points de suspension, qui laissaient entre eux trois intervalles." See also on the passage Lendle, *Schildkröten*, 64. On διάλειμμα see above on **19:11**.

9 **βασταγμάτων**: The term βάσταγμα is not used by Ath. Mech. or Apollod. (the latter uses ἄρτημα). See Trapp, *Lexikon*, s.v., and above on **22:57** (βασταγή).

10 **όνίσκων . . . κριοδοχῆς**: The mechanism is described in somewhat more detail by Ath. Mech.; for a reconstruction of its operation see Lendle, *Schildkröten*, 58–60. The illustration on folio 20r shows two methods of holding the ropes, cylindrical rods at the rear, pulley wheels at the front. The illustrations in Paris. suppl. gr. 607, folio 23, and Vindob. phil. gr. 120, folio 32v, show only pulley wheels.

12 **ἐπιβάθρον**: The term and the description are from Ath. Mech. and here refer to a net suspended vertically on a board at the front of the ram to allow troops to climb to the breach in the wall created by the ram, as illustrated on folio 20r. Lendle, *Schildkröten*, 66, and Schneider translate "Stiege," De Rochas "échelle." The word is used elsewhere by the Anon. Byz. in the more usual sense of a drop-bridge or *pont-volant*: see on **2:11**.

17 **σχάριον**: The term is from Ath. Mech.; for discussion see Lendle, *Schildkröten*, 51: "das gesamte Grundgestell der Maschine"; Callebat and Fleury, *Vitruve*, 254 n. 14:1:2; and Marsden, *Treatises*, 84. Dain, *Tradition*, 20 n. 1, comments that the use of σχάριον for ἐσχάριον consistently in Vat. gr. 1605 is one of the indications that the Anon. Byz. was using a manuscript tradition of the poliorcetic corpus followed also by Vindobonensis phil. gr. 120, rather than that of Paris. suppl. gr. 607.

23 **οίονει περίφραγμα**: The Anon. Byz. has added the simile.

25–26 **ἐξαχῶς ἐκίνουν**: Ath. Mech. (26:1–2) explains: Κινήσεις δὲ τὸ ἔργον λαμβάνει ἕξ· τὴν εἰς τὸ ἔμπροσθεν καὶ τὴν εἰς τὸ ὀπίσω, καὶ τὰς εἰς τὰ πλάγια, καὶ τὴν ἀνάνευσιν καὶ τὴν ἐπίνευσιν; for discussion see Lendle, *Schildkröten*, 67–68. See also D'Ooge, *Nicomachus*, 238 n. 4, on the six categories in Neo-Pythagorean arguments and below, **54:5–6**.

28 ἐκινεῖτο: For Ath. Mech.'s οἰακίζεται. See below, **26:2**.

28 προσφερόμενος: The Anon. Byz. adds, perhaps to explain the need for a hundred men, a number that seems excessive for operating the ram once in place, but that would be needed to move it into position. See Lendle, *Schildkröten*, 69 n. 86.

29 τάλαντων . . . τετρακισχιλίων: For doubts about the weight see Lendle, *Schildkröten*, 69 n. 87.

Chapter 26. Historical Methods of Moving Rams

A summary passage on battering rams with items drawn mainly from Ath. Mech. (particularly from his history of the origin of the battering ram, which he in turn drew from Agesistratus), as noted below.

1 ὑπὸ πλήθους ἀνδρῶν: Cf. Ath. Mech. 9:15–10:2: Γήρας . . . ὁ Καρχηδόνιος . . . τὸν κριὸν . . . οὐκ ἐκ ἀντισπάστων εἶλκεν, ἀλλ' ὑπὸ πλήθους ἀνδρῶν προωθούμενον ἐποίησε. On Geras of Carthage, known only from the references in Ath. Mech. and Vitruvius, see Callebat and Fleury, *Vitruve*, 241 n. 2.4, and W. Kroll, *RE*, suppl. VI:73.

2 οἰακίζονται: The verb is found at Ath. Mech. 26:4; the Anon. Byz. substituted ἐκινεῖτο for it above at **25:28**.

3 ἀντισπάστων: The term is from Ath. Mech., for example, 13:10–14:1: Ἴστα δὲ καὶ κριοδόχην ἐν αὐτῇ, ἐφ' ἧς καὶ τὸν κύλινδρον ἐπετίθει (i.e., Diades), δι' οὗ προωθούμενος ὁ κριὸς δι' ἀντισπάστων ἐνήργει τὴν χρεῖαν.

3 κύλινδρων: Cf. Ath. Mech. 10:4–5: Μετὰ ταῦτα (i.e., the invention of Geras of Carthage) δὲ ἐποίησάν τινες ἐπὶ κυλίνδρων προωθούμενον τὸν κριὸν καὶ οὕτως ἐχρῶντο.

6 τεχνίτη: The Anon. Byz. adds; see above on **1:9**.

Chapter 27. Scout-Ladder of Apollodorus

The Anon. Byz. here follows and greatly elaborates on Apollod. 161:9–164:4. For discussion of the device with illustrations see Lendle, *Texte*, 28–35; on its impracticality as well as the Anon. Byz.'s failure to understand the design in Apollod.'s text see Blyth, "Apollodorus," 140–41 and

n. 31. It is illustrated in the manuscript on folio 22v and the base alone on 23r. The version of Apollod. is illustrated in Paris. suppl. gr. 607, folio 36 (reproduced by Schneider, *Apollodoros*, pl. 6, fig. 23, and Wescher, 163, fig. 65).

6 τετράγωνα: “Squared,” that is, with four faces at right angles.

6 ἑτεροπλατῆ: With faces of unequal width. See Lacoste, “Poliorcétiques,” 256 n. 1.

6–7 πλάτος . . . ὀκτώ: The Anon. Byz. adds the dimensions; see Lendle, *Texte*, 29.

12–14 ἀπεναντίον . . . ὀρθοῖς: For Apollod.’s μεταξύ δὲ αὐτῶν ἄλλο ἐντίθεται ξύλον ἐπὶ τοῦ ἐδάφους πρὸς ὀρθὰς τῷ πρώτῳ κειμένῳ.

15–16 ἦτα λιτὸν . . . διπλόγραμμον: The simile is added by the Anon. Byz. and see below, **28:4**. On the use of λιτός for “uncial” see Atsalos, *Terminologie*, 217ff. For its implications for the Anon. Byz.’s date see the Introduction, 4.

17–18 ἀντιβαίνοντα . . . ἐπιστηρίζοντα: A periphrasis for Apollod.’s ἀντήρειδες (“stanchions”).

21 τὰ τέσσαρα: That is, the two uprights and the two swing-beams.

30–31 Ταῦτα . . . κατερχόμενα: A periphrasis for Apollod.’s κηλώνια (“swing-beams,” “swipes”). The Anon. Byz. also uses ἐμβαλλόμενα and ἐγκλινόμενα for these beams; as his aim is to avoid technical terms, it seems best to translate literally, although the term “swing-beams” or “swipes” would simplify the translation.

34–41 Ἄπο . . . μετάρσιον: The Anon. Byz. here interprets the brief comment in Apollod. on the handle (162:10–11: κατὰ δὲ τὸ ἄλλο ἔλκυστρον ξύλον ποδῶν μὴ πλείον ἢ τὸ μῆκος). For discussion see Lendle, *Texte*, 31, who sees the Anon. Byz.’s view as essentially correct.

35–36 τὸ ἀναχθὲν ἔκτον μέρος: That is, when the swing-beams are lowered, the bottom sixth is raised.

44–45 διὰ . . . περόναις: The Anon. Byz.’s interpretation of Apollod.’s διὰ τὸ διπλοῖς κηλωνίοις ἐπεξεῦχθαι: see Lendle, *Texte*, 32.

45–49 Δεῖ . . . ἀτρεμεῖν: The Anon. Byz. adds. The meaning of στροφομάτιον is difficult. The primary meaning is “hinges,” but perhaps here = στρόφιγξ, “pivot pins,” “axles” (so LSJ at στρόφομα II). Barocius renders “verticulis” and Schneider “Zapfen.”

53 δισσως: On the Anon. Byz.’s interpretation of how the ladder is secured to the swing beams, see Lendle, *Texte*, 32.

57ff Ἔστω . . . : The Anon. Byz.’s dimensions for the device differ from and are considerably more elaborate than those of Apollod., so as to produce a ladder higher by 5 feet. For doubts about its practicality see Lendle, *Texte*, 33–34.

77–80 ἐκ βύρσης . . . πλάγια: For Apollod.’s θυρεοῦ τρόπον. The illustration shows two different forms of shield, both long, one semicircular at the top, straight on the bottom, the other pointed at both ends. While here a special-purpose device, more generally on the Byzantine long shield see Kolias, *Waffen*, 91.

81–86 Οὐ μικρὰν . . . κατάσκοπον: The Anon. Byz. adds. The concept of protecting the legs of the ladder with ropes is not found in Apollod. and may be a Byzantine innovation.

86–87 Εἰς . . . συμβάλλονται: The Anon. Byz. adds.

89 ἀπεκτεταμένα . . . ἀλλήλων: The Anon. Byz. adds.

92 τό τε κείμενον καὶ τὸ ὀρθωμένον: The terms are from Apollod. (163:3 and cf. 156:1–2 and 193:2), whose original work contained technical drawings no longer faithfully represented in any of the extant manuscripts of his text. On their nature in the original, “Grundriss . . . Aufriss,” “ground plan . . . elevation,” see Sackur, *Vitruv*, 19–21; Lendle, *Texte*, 34, 182; idem, *Schildkröten*, 109; and Blyth, “Apollodorus,” 133 and n. 16 and 144 and n. 39. The illustrations in Vat. gr. 1605 (folio 22v) show the scout-ladder in two positions, one fully raised, the other partially so, with the swing-beams parallel to the ground. This suggests that the Anon. Byz. and/or the artist did not understand or does not use the terms technically; the translation attempts to retain this latter interpretation. The illustration of Apollod.’s σκοπός in Paris. suppl. gr. 607, folio 36 (reproduced by Schneider, *Apollodoros*, pl. 6, and Wescher, 163, fig.

65), is also not a ground plan or elevation. See also below, 57:1.

Chapters 28–29. Additional Bases for the Scout-Ladder

The bases described here are not found in Apollod. and are apparently an addition of the Anon. Byz. The first with single planks on either side is depicted on folio 23r.

4 ἦτα λιτόν: See above, on 27:15–16.

5 γλωσσίδος: For the term see Trapp, *Lexikon*, s.v.

29:12 τεχνίτης: On adaptation by the craftsman see above on 1:9.

13 συμμετρίαν: See below on 38:19.

14 τρεῖς διαστάσεις: Cf. below, 30:17–18.

Chapter 30. Portable Siege Towers

The portable towers of Diades and Charias are described in chaps. 30, 32, and 36; they are also found in Ath. Mech. 10:10–12:10 and Vitruvius X:13:3ff. The Anon. Byz. has material not found in either of his predecessors. Sackur, *Vitruv*, 98ff, advanced the theory that he used a now lost source called by Sackur “Athenaeus Minor.” However, Dain, *Tradition*, 19, reasonably suggests that: “les ajouts ne sont pas tels que notre auteur n’ait pu les donner de son propre cru.” Lammert, “Apollodoros,” 331, concludes that “der Anonymus Byzantinus kannte nur den Athenaeus Major.” See also Lendle, *Texte*, 76 n. 103, who characterizes Sackur’s theory as “unhaltbare.” For discussion of the towers of Diades and Charias see Sackur, *ibid.*, 106ff; Lendle, *Texte*, 71–77; Callebat and Fleury, *Vitruve*, 242ff; Garlan, *Recherches*, 226–28; and Fleury, *Mécanique*, 289–92.

The towers of Apollod. are described in chaps. 31, 33–34, 37, and 39, following the text of Apollod. (164:8–167:9 and 173:9–174:7), with the Anon. Byz. inserting his own mathematical comments in chaps. 35 and 38. For detailed discussion of Apollod.’s tower see Lendle, *Texte*, 77–101, and Sackur, *Vitruv*, 26–30. The tower of Apollod. is illustrated on folio 26r.

1 Διάδης . . . καὶ Χαρίας: On Alexander’s engineers see *RE* V:305 (Diades, 2), III:2:2133 (Charias, 11), suppl. VI:26–27, and Schneider, *Athenaios*, 57 n. 10:10

1 Πολυεΐδου τοῦ Θετταλοῦ: On Philip of Macedon's engineer see Ziegler, *RE* XXI:2:1658–59 (Polyidos, 6); Callebat and Fleury, *Vitruve*, 242; Schneider, *Athenaios*, 57 n. 10:9; and Garlan, *Recherches*, 237.

3–4 πρῶτοι . . . ἐξεῦρον: Ath. Mech. (10:10–12) has Διάδης . . . φησιν ἐν τῷ μηχανικῷ αὐτοῦ συγγράμματι εὐρηκέναι τούς τε φορητοῦς πύργους καί τὸ λεγόμενον τρύπανον καὶ τὸν κόρακα καὶ τὴν ἐπιβάθραν. Vitruvius (X:13:3) has “Diades scriptis suis ostendit se invenisse.” Garlan, *Recherches*, 227–28, notes that at best Diades could have devised new models of the drop-bridge and portable tower, which were known and used before he worked.

3 τρύπανα: For Diades' “borer,” an iron-pointed beam on rollers, moved by a windlass, for piercing walls, see Schneider, *Athenaios*, 58 n. 14:4; Garlan, *Recherches*, 238 with illustration; Lendle, *Texte*, 132; Callebat and Fleury, *Vitruve*, 250 n. 13:7:1; and Fleury, *Mécanique*, 297–99. It is different from the τρύπανον of Apollod., a handheld drill, on which see above, 17:2.

3 διαβάθρας: For Ath. Mech.'s ἐπιβάθραν; the Anon. Byz. uses the two terms interchangeably. See above on 2:11.

4 φερομένους διὰ τροχῶν ξυλίνους πύργους: Ath. Mech. has φορητοῦς πύργους. On the device and terminology see above on 2:6.

5–7 τὴν δὲ βάσιν ἐτετραγώνιζον . . . τιθέντες: Ath. Mech. has πύργον . . . δεῖ γενέσθαι . . . τὸ δὲ πλάτους ἔχοντα πῆχεις ἰζ'.

8 ἰσοτετράγωνον: On the term see Sophocles, *Lexicon*, s.v.

9–10 πέμπτου μέρους . . . ἐμβαδοῦ: On the “contraction” Ath. Mech. (11:5–6) has συναγωγὴν δὲ τοῦ πλάτους εἰς τὸ ἄνω τὸ πέμπτον μέρος, Vitruvius (10:13:4) “Turrem autem minimam ait <i.e., Diades> oportere fieri ne minus altam cubitorum LX, latitudinem XVII, contracturam autem summam imae partis quintam.” The Anon. Byz. presents a contraction of area rather than of the width, and, as is clear in his numerical example in chap. 35, *to* one-fifth rather than *of* one-fifth, that is, he sees the area of the top story as one-fifth the area of the bottom story. For the consequences of this incorrect interpretation see Sackur, *Vitruv*, 34 n. 1 and 106ff. For a contraction similar to that of the Anon. Byz. see Diodorus Siculus, 20:91:4, the *helepolis* of Demetrius, in the siege of

Rhodes, whose base had a reported area of 4,300 square feet, its upper story 900.

11–12 Τοὺς δὲ μείζονας . . . πεντεκαίδεκαστέγους: A fifteen-story tower of Diades and Charias is not mentioned by either Ath. Mech. or Vitruvius. See Schneider, *Athenaios*, 58 n. 11:9.

15 κδ' ἔγγιστα: Ath. Mech. has κγ' c' (231/2).

17–18 τουτέστι . . . πάχος: The Anon. Byz. adds.

19 συμμετρίαν: See below, **38:19**.

20 Ἐξατρόχους . . . ὀκτατρόχους: The wheels of Diades' and Charias' towers are not mentioned by Ath. Mech. or Vitruvius. Ath. Mech. (18:16) does describe a χωστρίς χελώνη as ὀκτάτροχος, a term also used by the Anon. Byz. at 15:3 and apparently reused here. See Lendle, *Texte*, 73, and Schneider, *Athenaios*, 58 n. 12:11.

Chapter 31. Apollodorus' Tower

1 σεμνότερον: On the sense “smaller” see *De admin.* 53:265; E. Dawes and N. Baynes, *Three Byzantine Saints* (Crestwood, N.Y., 1977), 74–75; and Nikephoros Phokas, *Praecepta militaria* I:96–97, III:11, IV:37.

5–6 δίχα . . . παρεξοχῆς: For Apollod.'s κατὰ δὲ τὰ ἄκρα ἀποχωροῦντα ὡς πόδα.

8 μεσοστάται: For the “center-stanchions” and “side-stanchions” (παραστάται), which together constitute the composite uprights supporting each story, see Garlan, *Recherches*, 226 n. 7, and Sackur, *Vitruv*, 26–30.

12–13 οὓς . . . ὠνόμασαν: The Anon. Byz. adds. Ath. Mech. (11:6, 12:2) reports this usage by Diades and Charias.

16 κανονίων περιτομίδων τε καὶ χελωνίων: The terms are from Apollod.; see above on **22:33** and Lendle, *Texte*, 79.

16–19 ἦτοι . . . τιθεμένοις: The Anon. Byz. adds the simile for the χελώνια; see above on **22:35–37**.

20 Τοῖς ὀρθίοις . . . οὔσιν: For Apollod.'s Κατὰ δὲ τοὺς ὀρθοστάτας.

21–22 ἴσα ὄντα κατὰ μῆκος: That is, the base is a square.

22 ἀντιζυγίδας: The term ἀντιζυγίς does not appear in his classical sources, but is used here by the Anon. Byz. to represent the timbers placed at right angles to the double timbers to complete the lower base. Apollod. (165:14) simply calls them ἕτερα ξύλα. For views on their nature and number in Apollod. see Lendle, *Texte*, 80–81, and Sackur, *Vitruv*, 28 n. 1. Trapp, *Lexikon*, s.v., has “(Ersatz-)Verbindung.”

24–25 ἴσον . . . ἀπέχουσιν: This phrasing suggests that the Anon. Byz. does not see the uprights of the tower leaning inward to accommodate the progressively shorter timbers; see below on 33:2–3.

32 παραστάται: See above on 31:8.

Chapter 32. The Tower of Diades and Charias

1 δυσέρετοί εἰσι: Cf. the recommendation (taken from Apollod.) for use of εὐπόριστα τῆ ὕλῃ at 2:15 and see above on 22:63–64.

2 τοῖς περί: See above, 25:1.

Chapter 33. Apollodorus' Tower

2 ἐπιζυγίδας: See Lendle, *Texte*, 80–81, on Apollod. 165:12: “Zwar ist klar, dass mit ἐπιζυγίδες Querbalken gemeint sind, welche die Verbindung zwischen den ζυγά herstellten.”

2–3 ἐλάσσονας τῷ μήκει ποδὸς ἄχρη: For Apollod.'s ἐλάττονες τῶν κάτω τῷ μήκει πόδα. The method by which the tower's uprights converged to allow for the progressive shortening of the upper horizontal timbers is not completely clear in either Apollod. or the Anon. Byz. On the problem in the text of Apollod. see Lacoste, “Poliorcétiques,” 260 n. 1, and Lendle, *Texte*, 80. Sackur, *Vitruv*, 34 n. 1, concluded on Apollod. that “die Eckständer um dieses Mass natürlich vom Lot abweichen müssen”; for such an approach see Diodorus Siculus XX.91.4: κίονες . . . συννευκότες πρὸς ἀλλήλους of a tower built by Demetrius for the siege of Rhodes. On the Anon. Byz. Sackur suggests, “Man kann sich deswegen nicht des Verdachts erwehren, dass der Byzantiner senkrechte Pfosten annimmt, die in jedem Stockwerk absetzen (wie es auch das

Bild zeigt),” a view he characterizes as “einen allerschlimmsten Fehler, der es zu einer vollständigen Unsinnsdarstellung macht.” Lacoste (*ibid.*) however, saw the Anon. Byz.’s approach, although not stated in Apollodorus, as “d’ailleurs parfaitement rationnelle.”

7 *περίπτεροι* . . . *περιδρόμους*: The terms are taken from Ath. Mech. (11:8, 13:7, 10). For the former as “narrow ledges” for fighting fires see Lendle, *Texte*, 72–73; on the latter as “inner galleries,” *ibid.*, 75 and n. 102. See also Garlan, *Recherches*, 227, and Callebat and Fleury, *Vitruve*, 245 n. 13:5:1 and below, **39**:13–14.

8–9 *εἰς τὴν* . . . *ἐκβοήθησιν*: Cf. Ath. Mech. 12:5–6: *εἰς τὴν ἐκβοήθησιν τῶν ἐμπυρισμῶν*.

12–15 *τροχοὺς* . . . *ἥμισυ*: On the passage see Blyth, “Apollodorus,” 136–37 and nn. 26 and 27; Lendle, *Texte*, 40 n. 40 and 82. The phrase *λεπίσι ψυχρηλάτοις* occurs four times in Ath. Mech., at 17:2 of the *τριπήχεις* wheels of a *χελώνη χωστρίς*. Blyth suggests that the Anon. Byz. “must have found these words or something very like them in his text of the [i.e., Apollod.’s] *Polioretica*. They may have been a marginal gloss that did not get into the main tradition.” Lendle, *ibid.*, 82, argues that wheels of such large size would be too close together to allow for a stable structure and also could scarcely have been accommodated under the structurally important crossbeams. He suggests that the reading *δ’* may be an error for *δύο*. As the archetype manuscript has *τεσσάρων*, it seems best to allow it to stand in the text.

20 *ἀπαρεμποδίστως*: Cf. above on **13**:32.

21 *σύμπηγμα*: From Apollod. 166:6. LSJ, s.v., gives “superstructure,” “framework.”

Chapter 34. Apollodorus’ Tower

4 *πρὸς αὐτόν*: The text here seems to describe another center-stanchion at the next higher level placed on top of the lower center-stanchion (*αὐτόν*). The illustration on folio 26, however, shows the outer side-stanchion placed on top of the lower center-stanchion, the center-stanchion on top of the lower inner side-stanchion, etc., as the tower legs work inward to allow for the progressively shorter cross beams and the narrowing of the whole structure.

11 κλίμακας: On placement of the ladders see Lendle, *Texte*, 86–87.

17 πλαγίους: That is, slanted away from the tower to prevent being pulled out by the tension; so Lendle, *Texte*, 84.

19 ἐξ ὀλίγων καὶ μικρῶν ξύλων: The phrase is from Apollod.; for his stress on use of small and readily available materials, in contrast to the long timbers used by Hellenistic engineers, see Lendle, *Texte*, 77–78. See also above, **2**:15–19 and **22**:63–64.

20–22 (μ)ήτε . . . δηλώσας: The Anon. Byz. adds. See Sackur, *Vitruv*, 107, who suggests that Apollod.’s intent is to require no calculation by the craftsman other than a shortening of the timbers by 1 foot at each story. For adaptation by the craftsman, however, see above on **1**:9.

Chapter 35. Numerical example added by the Anon. Byz.

On the error here of the contraction as one of area rather than width, as well as *to* one-fifth rather than *of* one-fifth see Sackur, *Vitruv*, 34 n. 1 and 109f, and above on **30**:9–10.

6 να΄ πέμπτον: On the value $1/5$ for the contraction, see above, **30**:9–10.

8 ἐπτὰ ἔκτον ἔγγιστα: The value is an approximation for an irrational number. The calculation for the approximation should be $71/6 \times 71/6 = 49 + 7/6 + 7/6 + 1/36 = 5113/36$; see Schneider, 51 n. 1. The multiplication of the two fractions by each other ($1/6 \times 1/6$) is omitted. For methods of approximating square roots of non-square numbers, see Heron, *Metrica* I:8, E. M. Bruins, *Codex Constantinopolitanus* (Leiden, 1964), III:191–92, and Heath, *History*, II:51–52 and 323–26, etc. For use of sexagesimal fractions in such calculations, see Heath, *History*, I: 60–63.

9–10 λεπτά . . . λεπτά πρώτα: On the use of “minutes” (λεπτά or πρώτα λεπτά) in the sexagesimal system of fractions, see Heath, *History*, I:45.

12 εἰς τὸ μέρος: The fractional remainder ($140/60 = 2$ and $20/60$) would be $1/3$ rather than $1/5$.

16 ἐπέμβασιν: The term is not found in Apollod. or Ath. Mech. It also occurs, together with παρέμβασις, below in chap. **37**. Barocius trans-

lates both terms with “super adiectione”; Schneider renders the former with “den Raum . . . verringern” and the latter once “Verkürzung” in chap. 37. LSJ, ἐπέμβασις 2 has “pl., *steps*.” The terms appear to refer to the progressive decrease in size of the timbers delimiting the area of each story. I have translated with “modulation” based on Vitruvius (IV:3:3), who speaks of a “modulus, qui Graece *embater* dicitur, cuius moduli constitutione ratiocinationibus effiuntur omnis operis distributiones,” that is, a rhythm in pacing or spanning. Παρέμβασις below is apparently used in a similar fashion.

Chapter 36. Diades and Charias

2 οἱ μὲν περί: See above on 25:1.

6–8 τό τε σύμπαχον . . . συνηρίθμουν: The observation is not found in the Anon. Byz.’s sources and is apparently his own; for its correctness and discussion of the calculations in the preceding passage, see Lendle, *Texte*, 76, and Sackur, *Vitruv*, 110–11.

7 ἀετώματι: See above on 22:41.

Chapter 37. Apollodorus’ Portable Siege Tower

4 ποδῶν ἕξ . . . παρέμβασιν: The Anon. Byz. adds; the timbers would decrease from 16 feet in length to 10 feet, the area from 256 to 100 square feet, as the tower rose to six stories. On παρέμβασις see above, 35:16.

5 τρίτον δὲ καὶ εἰκοστὸν ἔγγιστα: 23/60 is the closest sexagesimal approximation to 100/256 (see above on 35:8). The conclusion is added by the Anon. Byz.

8 ἐνὸς . . . ἐπέμβασιν: The Anon. Byz. adds.

9–10 ἐνὸς . . . παρέμβασιν: The Anon. Byz. adds.

10 ὡς προείρηται: See 35:17.

12 ἐπὶ καὶ μέρους ἕκτου: See above on 35:8.

13–16 ἐννέα . . . ἕξ . . . πέντε καὶ μέρους: Presumably half the diameter of the wheels and the thickness of the decks would be added to get the 60 feet.

Chapter 38. Proportional Relation of the Towers

The Anon. Byz. sets the towers of Diades and Charias and Apollod. in the context of a proportional relationship. Sackur, *Vitruv*, 109, suggested that “der gelehrte Pedant” sought in this comparison of two disparate texts to create “ein Turmproblem.” The extensive use of *συμμετρία*, *συμφωνία*, *ἀναλογία*, and *λόγος* (ratio) here and elsewhere goes far beyond anything found in the classical descriptions. Apollod. makes no mention of such relationships and uses *σύμμετρος* elsewhere only once (180:10); Ath. Mech. (12:9–10) says of Diades and Charias only Ὅμοίως δὲ καὶ ἐπὶ τοῦ ἐλάττονος πύργου ἢ διαίρεσις τῶν στεγῶν τὸν αὐτὸν λόγον ἐλάμβανεν and does not use *σύμμετρος* at all. Notably the Anon. Byz. provides (see on **38:11–12**) a definition of *συμφωνία* that is similar to a definition of *συμμετρία* found in Aristotle’s *De lineis insecabilibus*. For discussion of the possible Pythagorean origin (esp. from Philolaus) of the concept and its applications in art and architecture, see F. J. Pollitt, *The Ancient View of Greek Art* (New Haven, Conn., 1974), 12–22 and 256–58, and P. Gros, *Vitruve, De L’architecture, livre II* (Paris, 1990), 56–60. For the Anon. Byz.’s reference to Philolaus see above, **3:26–27**, and to Pythagoreans, below, *Geodesia* **8:13–14**.

6 ὁ πῆχυς . . . : On the measurement system see the Introduction, 23.

11–12 ὅτι . . . μετροῦνται: Cf. Aristotle, *De lineis insecabilibus* 968b6: *σύμμετροί εἰσιν αἱ τῷ αὐτῷ μέτρῳ μετρούμεναι*; and Heron, *Definitiones* 128: *νυνὶ δὲ Εὐκλείδῃ τῷ στοιχειωτῇ (X, def. 1) ἐπόμενοι περὶ τῶν μεγεθῶν φάμεν, ὅτι σύμμετρα μεγέθη λέγεται τὰ ὑπὸ τῶν αὐτῶν μέτρων μετρούμενα*. See also below, **51:28–29**, and the Introduction to chap. 38.

18–19 τὸν αὐτὸν . . . λόγον: The phrase is repeated with *σώζουσα* for *ἔχοντες* below at **51:28–29**.

19 *συμμετρίαν* . . . *συμφωνίαν*: For the combination see below, **51:18–19** and Heron, *Bel.*, 112–13.

20 φορητῶν πύργων: See above on **2:6**.

20–21 οἱ περὶ . . . τοὺς περὶ: See above on **25:1**.

Chapter 39. Apollodorus' Tower: stability, fire fighting.

The Anon. Byz. draws here on Apollod. 173:9–174:7; for discussion see Lendle, *Texte*, 98–99.

2 ἰσοπέδιος ὁ πρὸς τὴν βάσιν: The Anon. Byz. adds.

3 ἀνωφερῆς τυγχάνη: For Apollod.'s κοίλωμα ἔχη.

3–5 ποιήσομεν . . . τόπον: The Anon. Byz. here interprets a problematic sentence in Apollodorus, an interpretation Lendle, *Texte*, 98–99, argues is incorrect; Lendle would emend the text of Apollod. (ὑπόθημα τῆ ὁμοία αὐτοῦ τοῦ πύργου συμπλοκῆ, προσερχομένη . . . πλατυνούση) to ὑποθήματ(α) ἢ ὁμοίαν αὐτοῦ τοῦ πύργου συμπλοκὴν προσερχομένην . . . καὶ πλατυνούσῃν. He concludes, “Geländevertiefungen in der Bahn des Wändelturms durch ein ‘Gewebe’ von sich kreuzenden Balkenlagen, deren Zusammensetzung sich nach dem Grad der zu überwindenden Vertiefung richtete, so auszugleichen, dass am Schluss eine ebene Oberfläche entstand.”

3 ὑπόθημα: The term is from Apollod.; cf. above, ὑπόθεμα, 13:15. For the possible nature of the device see above on 39:3–5.

4 ἐπὶ τῷ ἀνωμάλῳ: For Apollod.'s ἐπὶ τὸ ἀνάκλιμα.

6–7 ὅπως . . . συντηρήται: The Anon. Byz. adds.

8–9 ἐκ . . . φλογῶν: The Anon. Byz. adds. See above on 2:9.

8 πυροφόρων τριβόλων: Philo Mech. 94:9–10 (also 95:8 and 100:20–21) speaks of τριβόλους καιομένους στιππύῳ περιελιγμένους). Garlan, *Recherches*, 386, compares Philo Mech.'s device to Aeneas Tacticus' (33:2) description of wooden pestles with iron spikes and combustible materials dropped from the walls to stick into siege machines and set them on fire. See also Leo, *Taktika* XIX:58: Καὶ τρίβολοι δὲ μείζονες σιδηραὶ ἢ ἐν σφαιρίοις ξυλίνοις ἤλοι ὀξεῖς ἐμπεπηγμένοι, στυππίοις δὲ καὶ ἑτέρα ὕλη ἐνειλημμένη (leg. -μένη) ἐμπυρισθέντα καὶ κατὰ τῶν πολεμίων βαλλόμενα, εἴτα πίπτοντα ἐν τοῖς πλοίοις διὰ πολλῶν μερῶν ἐμπρήσουσιν αὐτά. Koliass, *Waffen*, 175–77, suggests that a fiery τρίβολος may be the prickly plant, attached to a fire arrow or missile, similar to the ἔγκεντρα ματζούκια, to cause it to stick in the wooden equipment. On the pas-

sage see also F. Lammert, *RE* VI.A.2:2414.

9–12 **μάλιστα** . . . **εὔθραστον**: The Anon. Byz. adds here to the text of Apollod., apparently from Ath. Mech. 17:14: **μάλιστα** μὲν φοινικίνους, εἰ δὲ μή, τῶν ἄλλων ὅσα εὔτονα ἐστὶ ξύλα πλὴν κεδρίνων, πευκίνων καὶ κληθρίνων· ταῦτα γὰρ ἔκπυρά ἐστὶ καὶ εὐκλαστα. On the resilience of palm see above on **13:22**; for questions about its resistance to fire, a quality also mentioned by Philo Mech., 91:3, ἐκ τῶν φοινίκων σανίδας . . . (ἰσχυραὶ γὰρ εἰσι καὶ δυσέμπρηστοι), see Lawrence, *Fortification*, 88.

13–14 **ἐπὶ** . . . **περιδρόμοις**: See above, **33:7**.

15–17 **διὰ τε** . . . **πληγαί**: For Apollod.'s ἵνα ἔχωσι τόπον συνελθεῖν καὶ ἐκλύσαι τὸ βέλος.

21 τῶν . . . **πεμπόντων**: The Anon. Byz. adds.

21–22 **εἰργασμένα ὡσὸν τεταριχευμένα**: The Anon. Byz. adds. On preservation with salt see *Georponika* 19:9: Περὶ ταριχείας πάντων κρεῶν; Koukoules, *Bios*, V:64–65; and generally on the method R. J. Forbes, *Studies in Ancient Technology* (Leiden, 1955), I:189.

26 **σίφων**: The term and its function here is from Apollod. For a description of such a device see Heron, *Pneumatica* I:38 and Landels, *Engineering*, 202. For similar use see *Vita Stephani Iunioris* (PG 100:1069–1186), col. 1176C: τοὺς ἐν αὐτῷ τῷ τόπῳ ἵσταμένους ὑδροστάτας τῶν ἐμπρησμῶν, οὐσπερ σίφωνα καλοῦσιν. See also D. Oleson, *Greek and Roman Mechanical Water-Lifting Devices* (Toronto, 1984), 28–29.

26–27 **κάλαμοι** . . . **ἰξενταί**: See above, **19:27**.

30–35 **Οὐ μικρὰν** . . . **πληγὰς**: Cf. Ath. Mech. 18:3–7: ἐπὶ δὲ τούτοις καταλαμβάνονται βύρσαις ῥεραμμέναις ὁμοίως ταῖς τύλαις, καὶ σάττεται εἰς αὐτάς **μάλιστα** μὲν ἔλαια ἢ τὸ καλούμενον θαλασσόπρασον ἢ ἄχυρα ὄξει βεβρεγμένα· ταῦτα δὲ εἰσι χρήσιμα πρὸς τε τὰς τῶν λιθοβόλων **πληγὰς** καὶ πρὸς τοὺς ἐμπυρισμούς, and Philo Mech. 99:26, κωδίους ὄξει βρέξαντα ἢ ὕδατι. See also Maurice, *Strategikon* X:3:12–13: Καὶ πρὸς τοὺς κριοὺς ἀντίκεινται τύλαι καὶ σακκία, γέμοντα ἄχυρα καὶ ψάμμον; Leo, *Taktika* XV:48: πρὸς τοὺς κριοὺς δὲ ἀντίκεινται τυλάρια καὶ σακκία γέμοντα ἄχυρα καὶ ψάμμον; and *De obsid.* 69:1ff: σοφίεσθαι δὲ πρὸς τὴν βίαν τοῦ μηχανήματος οὐ μόνον ὅπερ Ἰώσηπος ἐπετήδευσεν, ἀλλὰ καὶ

ἕτεροι τῶν παλαιῶν· σάκκους γὰρ ἀχύρου γεμίσαντας, πλὴν βεβρεγμένου διὰ τὸ μὴ ὑπανάπτεισθαι εὐχερῶς (= Josephus, *Bellum Judaicum* III:223). For vinegar as a fire retardant see Theophrastus, *De igne* 25:59–61; Pliny the Elder, *Naturalis Historia* 33:94; and Callebat and Fleury, *Vitruve*, 260 n. 3.3. For mats (ὑφάσματα) of hair, wool, or linen used to protect city walls against stone throwers, see <Περὶ Στρατηγίας>13:74ff.

31 **τύλια**: Cf. Ath. Mech. (18:4): τύλαις. For τύλιον = τύλη, see Wescher, 247 n. 16.

32 **δίκτηα ἐνόγρων βρύων**: The Anon. Byz. is here apparently paraphrasing Ath. Mech.'s θαλασσόπρασον. For βρύον as *alga, muscus marinus*, see Hippocrates, *De mulierum affectibus* 53:3: Ὅταν ᾧδε ἔχη, καταπλάσσειν βρύω τῷ θαλασσίῳ, ὃ ἐπὶ τοὺς ἰχθύας ἐπιβάλλουσι.

34 **πυροβόλων**: See above **2:9**.

36 **ἐκ τῶν . . . φλογῶν**: See above on **2:9**.

36–**40**:1 < . . . || **40**. . . >: On the lacuna (between folios 28v and 29r) see Dain, *Tiadiion*, 30–31. Wescher (248:3) noted that the missing material was presumably drawn from Apollod.'s section on ladders, 175:1–185:2.

Chapter 40. Single Ram between Ladders

The Anon. Byz. draws here on Apollod. 185:6–16. For discussion see Lendle, *Texte*, 19–22, with modern drawing, 22. The device is illustrated on folio 29v.

3 **ἰσοῦψῆ**: The Anon. Byz. adds.

3–6 **διὰ σανίδων . . . βολάς**: For Apollod.'s κανόσι καὶ σανίσι. On βεργῶν see above, **8:3–4**, on νεοσφαγῶν **15:18–19**, on πηλῷ **15:5**, and on πυροβόλα **2:9**.

9 **πρὸς τὴν ἀνάβασιν**: For Apollod.'s τῆς ἀναβάθρας.

12 **ἐνεργήσει**: For Apollod.'s ἐργάσεται.

13 **βαστάγμασιν**: For Apollod.'s ἀρτήμασιν; see above on **22:57**.

13 **παρὰ μικρόν τι**: For Apollod.'s μετρίως. The front hanger would be

slightly shorter than the back one so that the ram would be angled upward and thus strike the less unified parts of the wall. See Lendle, *Texte*, 20–21. See also above, chap. **23**.

14–16 ἵνα . . . κριομαχῶσιν: For Apollod.'s ἵνα ἐπὶ τὰς στέγας ἄνω κριομαχῶσιν οἱ ἐπιφέροντες. For discussion of the meaning of Apollod.'s ἐπὶ τὰς στέγας, which the Anon. Byz. here interprets as τὰ ἀνώτερα μέρη τῶν τειχῶν, see Lendle, *Texte*, 21. See also above on chap. **23**.

16 εὐκατάλυτον: The Anon. Byz. adds.

17 ἀνεστηκός: The Anon. Byz. adds.

17–19 ἀσύνδετον . . . ἐπιστηρίζονται: The Anon. Byz. adds.

18 προπύργια: Added by the Anon. Byz.; see Demetrakos, *Lexikon*, s.v: προκεχωρημένον ὄχρῳμα . . . προτείχισμα, προμαχῶν, and below, **55:23** where it refers to a rampart wall on a raft otherwise referred to there as a προτείχισμα.

Chapter 41. Rams on Ladders as Bridges

The Anon. Byz. draws here on Apollod. 185:16–186:3

2 εὐκόλως: The Anon. Byz. adds.

2–3 τοῖς . . . προειρημένοις: For Apollod.'s τοῖς πρότερον. There is no earlier reference in the extant text of the Anon. Byz. to περιφραγαί, but Apollod. 171:7–172:1, in a section on rams on portable towers, has ὅταν δὲ διαβαίνειν δέη ἐπ' αὐτοῖς, ἐγείρονται οἱ κόνονες, καὶ ἀεὶ ὀρθοὶ ἐστᾶσι, καλωδίῳ ἐξ ἄκρου ἐλκομένου τοῦ κάμακος δρυφάκτου τρόπῳ. This section of Apollod. was apparently included in the now lost portion preceding chap. 40 of the Byzantine paraphrase.

3 <γενομένων>: Cf. Apollod. 185:17: ὁμοίως τοῖς πρότερον δρυφάκτων ἐφ' ἑκάτερα γενομένων.

3 περιφραγῶν: For Apollod.'s δρυφάκτων (“rails”). For the form cf. *Georponika* 11:5:4. For an illustration of a ram with guard rails used to mount walls see folio 40r and below on **53:38–39**, ἐπιβατήρια. Cf. also below, **46:34–35**, Περιφραγαὶ . . . ἐκ βυρσῶν, on the sides of a wheeled ladder and attached drawbridge.

4–5 *περιστραφήσονται . . . παρατρεπόμενοι*: For Apollod.'s *περινεύουσιν ἐπὶ τὸν κρόταφον*.

5–6 *καὶ τὰ . . . διάχωρα*: The Anon. Byz. adds.

6 *καταγραφὴ*: See above, 1:3.

Chapter 42. Double Rams on Ladders

The Anon. Byz. draws here on Apollod. 186:4–187:6. See Lendle, *Texte*, 21–24, with modern drawing, 24. The device is illustrated on folio 30v.

1 *τάξιν καί*: The Anon. Byz. adds.

2 *ἐπερχομένην, ἴσην οὐδσαν*: The Anon. Byz. adds.

3 *ἦτοι ὀρθήν*: The Anon. Byz. adds.

3–4 *καὶ τὰς μὲν . . . ἔχουσι*: The Anon. Byz. adds.

4–6 *τὰ δὲ ἀπ' ἀλλήλων . . . διάστημα*: For Apollod.'s *καὶ διεστᾶσιν οὐχ ὁμοίως, ἀλλὰ καὶ αὐταὶ εἰσι παράλληλοι*.

7–8 *καὶ κατὰ τοῦτο*: For Apollod.'s *μόνον ἐνί*.

9 *πρὸς . . . πλάγια*: For Apollod.'s *τοῖς κροτάφοις ἐκατέρωθεν*.

11 *μετακινήσαντες*: For Apollod.'s *ἐξώσαντες*.

12 *ἐκ τῶν ὀπισθεν*: For Apollod.'s *κατὰ νότου*.

12 *ὁμοῦ*: For Apollod.'s *ἐκότεραι*.

13 *δύο*: The Anon. Byz. adds.

13–14 *ἀλλ' ἢ . . . τῷ τείχει*: For Apollod.'s *ἢ μὲν μία ἐπιτίθεται*.

15–16 *καὶ τὸ . . . διάχωρον*: For Apollod.'s *ὅσον ἐστὶ καὶ τῆς κλίμακος ἀπὸ τῆς ἐτέρας τὸ διάστημα*.

16–18 *καὶ γίνεται . . . ἐπίζευξις*: The Anon. Byz. adds.

Chapter 43. Fighting from the Top Deck of Ladders

The Anon. Byz. draws here on Apollod. 187:7–187:11. See Lendle, *Texte*, 23.

1–3 *ἄνευ . . . τείχει*: The Anon. Byz. adds.