

Apollodorus of Damascus and the *Poliorcetica*

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APOLLODORUS OF DAMASCUS is a notable figure in the annals of Roman architecture.¹ As the chief engineer in Trajan's Dacian Wars, he was responsible for the great bridge over the Danube and wrote a description of it.² After the war he turned to civil engineering and architecture. He was certainly responsible for Trajan's Forum, and has been credited with the erection of the Column³ and with the design of the Pantheon.⁴ As he seems to have expressed himself freely and with an impatience of amateurs—which under Hadrian is said to have cost him first his position and then his life⁵—his written works might be expected to be interesting. His description of the bridge has not survived, but the Byzantine corpus of poliorcetic works includes an item, the Πολιορκητικὰ ἐκ τῶν Ἀπολλοδώρου (hereafter *Poliorcetica*), that contains material

¹ Authorities referred to are listed in nn.9–11 *infra*. In references to Trajan's Column, Roman numerals will indicate the scenes distinguished by C. Cichorius, *Die Reliefs der Trajanssäule* (Berlin 1896–1900) and arabic numerals the casts in the complete series, of which sets exist in the Lateran Museum (Rome) the Casts Museum (Berlin) and the South Kensington Museum (Victoria and Albert, London), being molded from the matrices in that order. There is also a full collection of photographs in *La colonna Traiana* (Rome 1942), with an introduction by P. Romanelli. Cichorius' plates have been reproduced on a smaller scale with introduction and commentary in F. A. LEPPER and S. S. FRERE, *Trajan's Column* (Gloucester 1988: hereafter 'Lepper and Frere'). I am grateful to the authors for the loan of a photograph, and to the library of the Ashmolean Museum Oxford for permission to photograph their copy of Cichorius.

² Procop. *Aed.* 4.6.13. Dio 68.13 goes into considerable detail and may derive from this.

³ W. Gauer, *Untersuchungen zur Trajanssäule I* (Berlin 1977) 76ff.

⁴ W. D. Heilmeyer, "Apollodorus von Damaskus, der Architekt des Pantheons," *JDI* 90 (1975) 316–47.

⁵ Dio 69.4; R. Ridley, "The Fate of an Architect: Apollodorus of Damascus," *Athenaeum* 67 (1989) 551–65, argues convincingly that the story of the execution is false.

on the construction of simple siege engines, judged by Choisy to afford a better insight into Roman carpentry than any other written source.⁶ This is accepted as authentic in the anonymous Byzantine works *De re strategica*⁷ and *Parangelmata Poliorcetica*⁸ and in all the modern editions,⁹ translations,¹⁰ and published studies¹¹ known to me. It has not impressed histori-

⁶ A. Choisy, *L'art de bâtir chez les Romains* (Paris 1873) 157. Sackur (n.11 *infra*) has a similarly high opinion.

⁷ G. Dennis, ed., *Three Byzantine Military Treatises* (Washington [D.C.] 1985), who dates it to the reign of Justinian; B. Baldwin, *BZ* 81 (1988), argues for a date in the seventh century or later; C. Zuckermann, *JÖB* 40 (1990) 209–24, attributes the work to Syrianus Magister, ca 600, roughly contemporary with the Ps.-Maurice *Strategikon*.

⁸ Tenth century; sometimes attributed to a fictitious 'Hero the Younger'. R. Schneider (*Griechische Poliorketiker* II: ΠΑΡΑΓΓΕΛΜΑΤΑ ΠΟΛΙΟΡΚΗΤΙΚΑ (= *Abh. Göttingen* N.F. 11.1 [Berlin 1908] 84f) identified it as an encyclopedia article written for Constantine Porphyrogenitus (915–59). It is based explicitly on an expanded paraphrase of Apollodorus.

⁹ C. (or K.) WESCHER, *Poliorcétique des Grecs. Traités Théoriques—Récits Historiques* (Paris 1867), provides the first critical edition, including Apollodorus, Athenaeus Mechanicus, Philo of Byzantium, and the *Parangelmata Poliorcetica*. The pagination of these volumes is followed by Schneider. The editions are excellent, except that the treatment of Apollodorus is often overly influenced by the *Parangelmata*; cf. n.17 *infra*. R. SCHNEIDER, *Griechischer Poliorketiker*, I: *Apollodorus* (= *Abh. Göttingen* N.F. 10.1 [Berlin 1908]) contains an introduction, text, German translation, with a few notes, index, and photographs of the illustrations. The second section, containing the *Parangelmata* (*supra* n.8), was published in the same year, and a third (posthumously), containing Athenaeus, as *Griechische Poliorketiker* III (= *Abh. Göttingen* N.F. 12.5 [Berlin 1912]). This is the text followed here. It is usually close to Wescher, but rightly rejects most of Wescher's readings based on the *Parangelmata* alone. On the other hand, Schneider's translation leans heavily on the *Parangelmata*; cf. n.30 *infra*; the comments of Sackur (n.11 *infra*) 34 n.1; and the criticism of Lendle, *Texte* xx n.9 (n.11 *infra*).

¹⁰ E. Lacoste, "Les Poliorcétiques d'Apollodore de Damas composées pour l'Empereur Hadrien," *REG* 3 (1890) 230–81: French translation of Wescher's text, with introduction by A. de Rochas d'Aiglun. There is no English translation.

¹¹ W. SACKUR, *Vitruv und die Poliorketiker* (Berlin 1925: hereafter 'Sackur'), contains chapters on Apollodorus and on the *Parangelmata* with reconstructions; E. SANDER, "Der Verfall der römischen Belagerungskunst," *HZ* 149 (1934: hereafter 'Sander') 457–67, arguing that the impracticality of the *Poliorcetica* indicates decline of Roman siegecraft; F. LAMMERT, "Die antike Poliorketik und ihr Weiterwirken," *Klio* 31 (1938: hereafter 'Lammert [1938A]') 389–411: a blustering reply to Sander; *idem*, "Zu den Poliorketikern Apollodorus und Athenaios und zur Poliorketik des Vitruvius," *RhM* 87 (1938: hereafter 'Lammert [1938B]') 304–33: an attempt to defend the illustra-

ans of art and architecture, however, who have not been willing to use it as a source.¹² This paper will discuss its authorship, noting dislocations in the text, variations in the type of content and the style, and disparities between the introduction and the main text that together indicate that some two-thirds of the text are later additions. It will be argued that the remainder represents almost unchanged a contribution to the planning of Trajan's first Dacian campaign by a competent engineer, and that the latter writer was not Apollodorus but a somewhat older contemporary—probably a fellow Syrian, possibly the master by whom Apollodorus was trained.

We may start with a brief summary. The work begins with a brisk but complex introduction addressed to an unnamed emperor, which claims that the author has been asked to supply designs for siege works to be used in a campaign in a backward area and sets out the principles and methods that he has used. He is sending a set of plans, with an assistant capable of supervising construction, and the text is an explanatory introduction (175.3f: ποιήσας οὖν ὑποδείγματα τινὰ ... ἔπεμψα διαγράψας, καὶ πᾶσιν ὑπελάλησα). There then follows a list of contents and a series of devices described in an order that follows roughly the progress of the siege of a hilltop fort. We start with devices used during the approach to protect the troops from objects rolled down the hill. These include a fortified ditch and triangular deflectors. Then comes a simple hand-held screen, followed by an equally simple method for protecting miners attacking the base of the wall from weights thrown from above, with advice on methods of mining. Other devices directed against the wall follow: a hand-held drill for use against brick

tions; O. LENDLE, *Schildkröten. Antike Kriegsmaschinen in Poliorketischen Texten* (= *Palingenesia* 10 [Wiesbaden 1975: hereafter 'Schildkröten'], includes (103–21) a reconstruction of the ram-shed in *Poliorketika* 153.8–158.10; cf. his *Texte und Untersuchungen zum technischen Bereich der antiken Poliorketik* (= *Palingenesia* XIX [Wiesbaden 1983: hereafter 'Texte']), with reconstructions of most of the other devices in the *Poliorketika*.

¹² W. L. MacDonald, "Roman Architects," in S. Kostof, ed., *The Architect* (New York 1977) 44–51, pays particular attention to Apollodorus but does not mention the *Poliorketika*. Lepper (Lepper and Frere 190) discusses the *Poliorketika* briefly in his treatment of Apollodorus, but regards the authorship as uncertain. Lendle (*Schildkröten* 103 n.118) notes that there is no reference in C. Leon, *Apollodorus von Damaskus und die trajanische Architektur* (diss. Innsbruck 1961: *non vidi*).

walls, a device for setting fire to crack stone, and a shed for a ram in the form of a triangular prism twice as tall as it is broad. The principles of the design of the shed and of ram suspension are discussed and some alternative arrangements for the latter suggested. There follows an elaborate device for raising a scout-ladder to look over the wall. Next comes a tower of a novel construction intended to obviate the need for long timbers, followed by five attachments: a drawbridge, a double ram with folded railings along the sides that can be pulled up to convert it into an assault bridge (*Fig. 1*), a pivoted sweep to push the enemy off the wall sideways (*Fig. 2*), an underplatform to level uneven ground, and hose-pipes for fire-fighting made from ox-intestines attached to a water bag made from the hide. For more rapid action, there is a description of a system of light interlocking ladders, which can be slotted together to form a long scaling ladder. Each section is twelve feet long and can be carried as part of the normal legionary equipment. There follows an elaborate method for assembling these ladders, and the system is developed and strengthened to provide a basis for further attachments, often using the ladders in pairs to form a scaffold or a roofed tower. The attachments are a falling knife for use against defenders on top of the wall (*Fig. 3*),¹³ a device for pouring over them hot oil or liquid, a single ram, a double ram, and a ram carrying a flail powered by a torsion spring (*Fig. 4*). Finally, for an assault across a river, there is an armored floating bridge.

The work reads reasonably smoothly, but suspicion is aroused by the impracticability of some of the designs, particularly towards the end in the additions to the tower and the ladders. This contrasts strongly with the pragmatic good sense of the early sections, as if we had moved from the world of the younger Pliny, in the early second century, to that of Vegetius and the anonymous author of the *De rebus bellicis* in

¹³ The knife, which is made from wooden boards, is shown in plan. The ladder is shown frontally. A perspective drawing would show the base of the ladder parallel to the side of the opposing wall, the ladder leaning towards the wall, and the knife in profile. That it is a knife and not, as Lendle supposes (*Texte* 13–16), a “Schlagbrett” or swatter, is shown by the claim that it will cut the enemy in half (διακοπῆναι, 181.14). Figures 1–4 are reproduced from Wescher’s drawings of the Ms. illustrations, by courtesy of the Cambridge University Library.

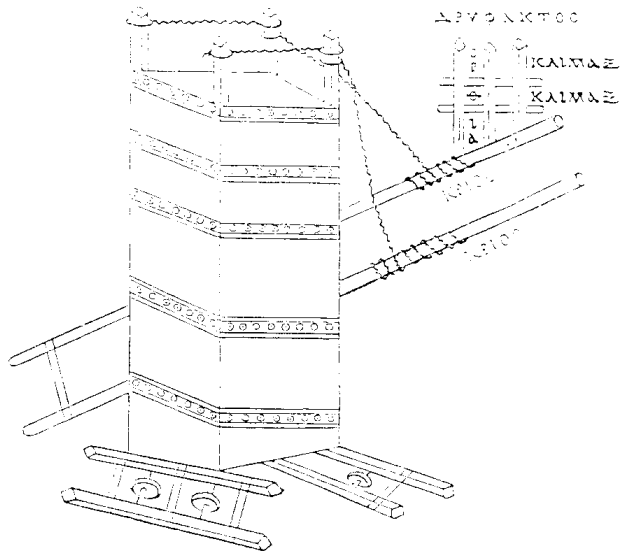


Figure 1

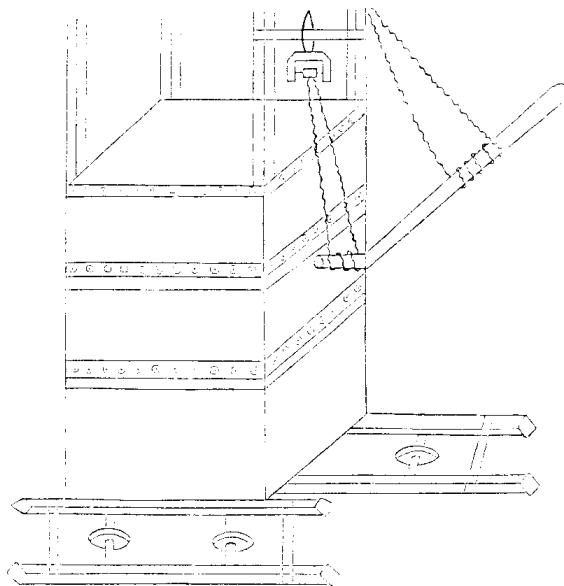


Figure 2

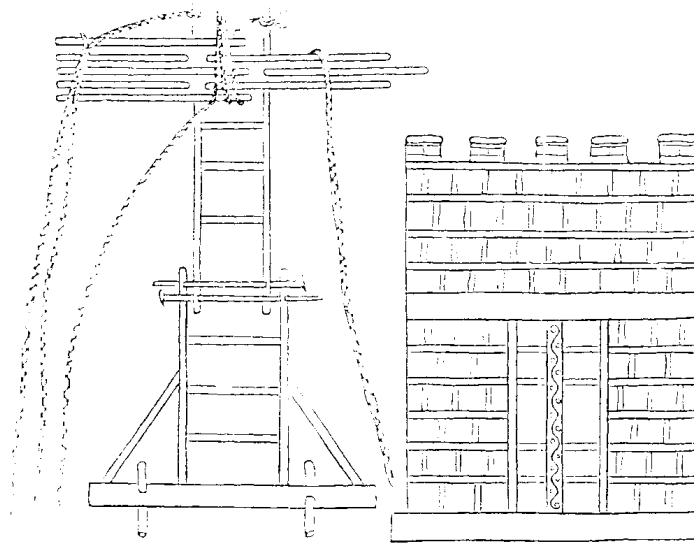


Figure 3

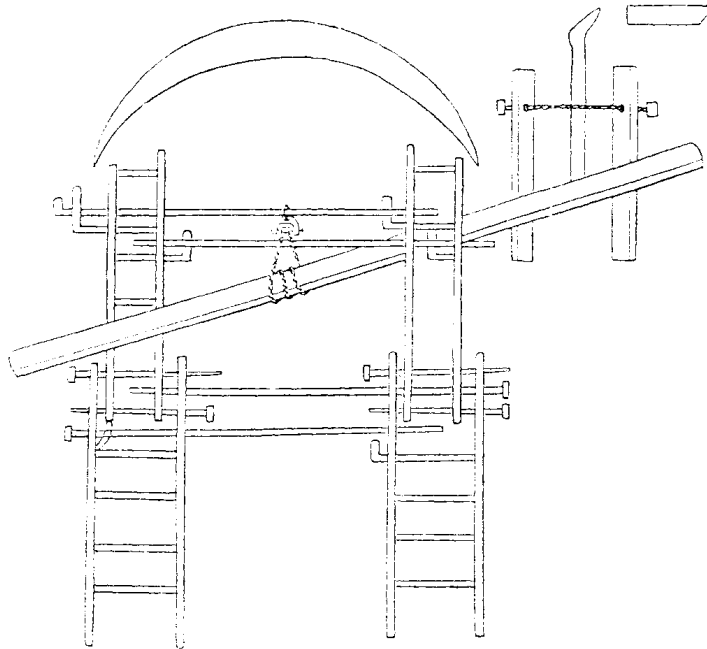


Figure 4

the second half of the fourth.¹⁴ Suspicion hardens to certainty when we examine the few passages in the text where grammatical, stylistic, or logical discontinuity suggest that individual sentences have been altered. All the major discontinuities occur in the practical material, and all have the effect of making the devices heavier and more complicated and/or providing space and connections for the impracticalities. In addition, the descriptions of individual devices frequently mention perspective drawings,¹⁵ corresponding to those that occur in the Mss., although the introduction refers to working plans. The perspective drawings were shown to be late by Sackur,¹⁶ and the text has been altered to fit them.

In order to disentangle the original text, it will be convenient first to remove the smaller interpolations from the practical devices, gaining as we do so an insight into the redactor's editorial style and purpose. We shall then separate the practical from the impractical, outline the stylistic differences between the two strata, and conclude with a discussion of the provenance and authorship of the original text. A list of the genuine and spurious passages will be given in an Appendix, and a more detailed analysis of the expository style will be given at a later date.

¹⁴ The terminus post quem for Vegetius is the death of Gratian (383), for *De rebus bellicis* the accession of Valens (364); most critics accept dates for each author close to the respective terminus post quem. For the *De rebus bellicis*, A. Cameron ("The Date of the Anonymous *De Rebus Bellicis*," in M. W. C. Hassall, ed., *De Rebus Bellicis*, Part I: *Aspects of the De Rebus Bellicis, Papers presented to E. A. Thompson* [=BAR International Series 63 (Oxford 1979)] 1–10) suggests 368/369. A fourth-century date is now contested by H. Brandt, who prefers the fifth century: *Zeitkritik in der Spätantike. Untersuchungen zu den Reformvorschlägen des Anonymus De rebus bellicis* (= *Vestigia* 40 [Munich 1988]), but Brandt's redating is opposed by A. Lippold, "Das Anonymus *de rebus bellicis* und die *Historia Augusta*," *Historia* 41 (1992) 253ff.

¹⁵ References listed in Lammert (1938B) 310–13.

¹⁶ Sackur 19–22, endorsed by Lendle, *Texte* xx with n.8, *Schildkröten* 122 and *passim*. The illustrations tell us nothing of value that cannot be derived from the text, and sometimes seriously misunderstand it: cf. especially the scout-ladder (n.21 *infra*). Lammert (1938B) argued that the references in the text proved that the archetype of the drawings, which was undoubtedly at least as early as the common ancestor of all our Mss., formed part of the original work. His inability to meet any of Sackur's criticisms on their own ground, however, invalidates and reverses the argument.

I. Small Discontinuities

(1) The list of contents begins, “There is need of” followed by a series of nouns and adjectives in the genitive describing most of the practical devices. References to several of the less practical devices have been inserted into the list in the nominative, producing a triple anacoluthon.¹⁷

(2) At the end of the description of the screen, we are told, as if by an afterthought, that its vertical poles should be of different heights to give the appearance of a shed. This involves reinterpreting the design and causes confusion.¹⁸

(3) A passage describing iron wheels fitted to the triangular deflectors reads so illogically in its context that it is obelized by both Wescher and Schneider. When the device is first introduced, it is described as “carried by the soldiers and dragged forward on squared timbers a foot thick, being smooth in form” (ὑπὸ ὀπλιτῶν φερομένη, ἀνάγεται τετραγώνοις ξύλοις ποδιαίοις λεία οὔσα τὸ σχῆμα); and as Schneider’s translation makes clear, the iron wheels have replaced iron pegs that pin the base of the device to the ground.¹⁹

¹⁷ 138.18–139.4; details are given in the Appendix, section III.

¹⁸ 142.5–143.5, revising 141.9, which should not be obelized. The muddle has had a serious effect on modern views of the whole text. The author of the *Parangelmata* rewrites the description trying to reconcile the new passage with the old, and his version led Wescher to the belief (*cf.* his note at Apollodorus 141.9) that the surviving Mss. of our *Poliorketika* represent an abbreviated version of a fuller archetype available to the author of the *Parangelmata*. Dislocations in the text that were not reproduced in the *Parangelmata* could therefore be attributed to that revision: those that were reproduced could be ignored, as acceptable to a native Greek speaker. For a juster estimate of the value of the expansions in the *Parangelmata*, see Sackur 34; *cf.* n.26 *infra*.

¹⁹ The Mss. read: ἡ δὲ χελώνη, ὑπὸ ὀπλιτῶν φερομένη, ἀνάγεται λεία οὔσα τὸ σχῆμα ἢ ἐκ τῆς ἔδρας τροχοῦς σιδηροῦς ἔχουσα, ἵνα ὅταν τίθηται, ἐμπήγνυται τῇ γῆ καὶ μὴ ὑπὸ τῆς συμβολῆς ἐπισύρηται (140.11f). Schneider obelizes from λεία to ἔχουσα and translates “sie hat am unteren Rande eiserne Spitzen, damit sie sich beim Niedersetzen in die Erde einbohrt,” as if he would have liked to read ἦλους ἐκ τῆς ἔδρας σιδηροῦς ἔχουσα but could not explain how it would arise. The redactor’s methods in altering the list of contents suggest a possible answer. He would have given his copyist the original text with ἦλους crossed out and τροχοῦς inserted. The copyist may have failed to notice the crossing out until he had copied at least the first letter of ἦλους and left the error uncorrected. Wescher also obelizes but suggests an emendation based on the version in the *Parangelmata*—whose editor, following his usual custom, has tried to mend the text with his own conjectures.

(4) At the end of the digging shed, which is built very simply by leaning timbers against the wall, after instructions for the digging have been given, we are told to fix flat-headed nails into the timber to hold a covering of clay, and it is then observed that this should be done out of range of the walls, and that it will therefore be advisable to assemble the sheds first and provide them with wheels (146.4–147.6).

(5) A similar addition of clay covering and wheels is made to the ram-shed. The description of the clay covering contains a reference to the addition to the digging shed.²⁰ The wheels are dragged in awkwardly when the description of the shed is first introduced²¹ and then boldly inserted into the main description in the sentence that had previously described the manhandling of the lighter structure: “Let the empty space between the lower beams receive the little wheels that handle the shed” (τὸ δὲ κένωμα τὸ μεταξὺ τῶν κάτω ζυγῶν [τροχίσκους] ἐχέτω τοὺς βαστάζοντας τὴν χελώνην).²² No description of the construction of the “little wheels” is given, and the diminutive is odd.²³

²⁰ 156.3–157.1: ταύτας δὲ πάσαις ταῖς χελώναις ὡς ἤδη εἶπον πυκνοὶ ἐμψησέσθωσιν ἤλοι κτλ.

²¹ 153.8–11: ἐὰν κριῶ θέλωμεν πύργον ἢ τεῖχος σείσαι, ποιήσομεν χελώνας κριοφόρους [ὑποτρόχους] ὑψηλὰς, αἱ τὸ ἄρτημα τοῦ κριοῦ φέρουσιν, ἵνα βιαία ἢ πληγὴ γίνηται· ὑψηλοῦ γὰρ ὄντος τοῦ ἀρτήματος, πλείον ἐπισπᾶται ὁ κριὸς διάστημα καὶ ἐκ μακροῦ ἐπιφερόμενος ἐνσίσταται πλέον (“If we wish to shake a tower or gate, we shall make tall [wheeled] ram-sheds to carry the suspension of the ram, so that the impact shall be violent, for the higher the point of attachment the further the ram is drawn back and the harder the stroke as it travels forward”). The wheels have nothing to do with the power of the ram, and upset the run of the sentence. Nor are they necessary. The usable area inside the shed is some nine feet wide and perhaps twenty feet long, which would accommodate some thirty-six men. It contains 460 ft³ (13 m.³) of timber, which must be softwood because it can be nailed and therefore weighs, with the nails, less than six tons before the ram is fitted. The men cannot lift it off the ground, but they should be able to slide it quite easily.

²² 155.9f. The singular κένωμα which made sense when the space was filled with men, is now another oddity. We should expect a plural, since there are almost certainly several parallel beams and each wheel would probably have a beam on either side. Cf. Lendle, *Schildkröte* 111–20.

²³ Used for small wheels by the Aristotelian *Mechanics* (Proem. 11), but the other uses quoted by LSJ suggest something very small. No use of the diminutive is noted in poliorcetic literature, unless it lies behind *orbiculus* (pulley) in Vitr. 10.2. A final mention of the τροχίσκοι in the suggestion that follows the addition of the clay (157.1–6), that wedges would be set beside τοὺς τροχίσκους τοὺς βαστάζοντας τὴν χελώνην to take the weight and avoid movement when the ram is in use, is obviously by the same hand.

(6) The tower has been altered in just the same way. A mention of wheels, with a justification for them, is jobbed into the introduction to make a very clumsy double conditional.²⁴ Then the description of the main structure is interrupted at a crucial moment by a long passage converting the tower to a mobile *helepolis* like that of Diades, so providing a base for the gangplanks and other delights that are to follow.²⁵ The wheels are even less satisfactory than those on the ram. We are given a single sentence (166.2–6): “Where the lower horizontal beams are separated, *trochiloi* are inserted, protruding higher on the under side, lifting the double timbers from the ground, so that the whole construction rolls and moves” (καθ’ ὃ δὲ διέστηκε τὰ κάτω ζυγὰ τὰ τοὺς μεσοτάτας δεξάμενα, τρόχιλοι ἐντίθενται ὑψηλότεροι ἐκ τοῦ κάτω μέρους ἐξέχοντες, αἴροντες ἀπὸ τῆς γῆς τὰ διπλᾶ ξύλα ἵνα κυλίηται καὶ κινῆται ὅλον τὸ σύμπηγμα). This clumsy and naive description, with its strange word *τρόχιλοι*—which does not seem to be used elsewhere for

²⁴ 164.6ff: πύργους ἐὰν δέη παρικοδομεῖν τοῖς τείχεσιν [ἀφεστῶτας ὥστε βάρη ἐπ’ αὐτοὺς μὴ πίπτειν] ἐκ μικρῶν ξύλων [ὑποτρόχους] ποιήσομεν οὕτως (“If it is necessary to build towers beside the walls, [far enough away to avoid heavy weights falling on them,] we shall make them out of small timbers, [with wheels underneath,] as follows”). The “small timbers” are needed so that they can be brought up rapidly to the screened site beside the walls where the tower is being built, and also to fulfill the promise in the introduction to use easily-provided material. That is the main point of the design, and the method is spelt out fully in the ensuing description. But ὑποτρόχους is out of place. The wheels will be mentioned only once more, and their construction is taken for granted; the natural place for them, if they had been part of the original design, would have been in the protasis “If we wish to build a wheeled tower...”

²⁵ The interruption contains in addition to the wheels three other misplaced items: advice that the horizontal beams of the upper storeys should be parallel to those of the lowest storey; that they should, however, be shorter so that the sides, which have in the first part of the description been set vertical, now taper inwards like those of the mobile tower of Diades (Vitr. 10.13.4f; Ath. Mech. 11.5f, 12.1f); and that guy-ropes should be attached to the corners of the tower and provided with elaborately-designed pegs. This lengthy passage (165.16–166.16) separates the completion of the lowest storey of the tower (164.7–165.16) from its sequel, which begins (166.16–167.7) “When this (*sc.* the building of the first storey) is done, it will be found that the first-mentioned uprights project ...” (τούτων γενομένων εὐρεθήσονται οἱ πρῶτοι μεσοστάται κτλ.), explaining how the uprights in the lowest storey are extended into the second and succeeding storeys. Their composite construction obviates the need for the long timbers used in earlier designs and is the main innovative feature of the design.

the wheel of a vehicle²⁶—gives no details of their construction nor of their diameter, though the latter affects stability and is a crucial datum in the design of a mobile tower.²⁷

(7) In the introduction to the ladders, there is a brief but enthusiastic statement in praise of ladders (175.2f): “Compared with the previous devices, ladders are easier to handle; they are also easy to provide, efficient, serviceable, and effective” (τῶν προειρημένων μηχανημάτων εὐχερέστεραί εἰσιν αἱ κλίμακες, καὶ εὐπόρισται, καὶ εὐεργεῖς, καὶ εὐχρησται, καὶ εὐδιόρθωται). That originally led into a description of an improved and specially light design, beginning (176.1): “Therefore they have

²⁶ The nearest parallel occurs in the Eleusis building accounts, e.g. *IG II²* 1672.156. The meaning ‘pulley’ is accepted by the editors, on the grounds that τροχίλεια means a crane (n. *ad loc.*), and by R. Martin (*Manuel d’architecture grecque* I [Paris 1965] 202f), but the τρόχιλοι at lines 239ff are sent away to receive iron fittings weighing at least 77 kg. in total, and it takes more than one wagon to transport them. The size implied and the amount of iron make it very unlikely that they are pulleys. They must be either capstans—for which, however, Vitruvius five times gives the Greek ἐργάτης (10.7.2 *bis*, 2.9, 11.1, 16.12)—or some sort of drum. Vitruvius repeatedly uses *tympanum* for this, unfortunately always in places where there is no parallel Greek source. At 10.2.5 he quotes two Greek equivalents for the large *tympanum*, or tread-wheel, but both are irrecoverably corrupt. At 3.3, however, he gives *trochilus* as an equivalent for *scotia*, a concave molding, and the metaphor rather strongly suggests the hollow drum of a tread-wheel, seen from the inside. Theophrastus (*Hist. Pl.* 4.3.5) refers to *trochiliae* in Libya powered by animals.

²⁷ As Lendle points out (*Texte* 82), those described in the *Parangelmata* are too large. Nor is that their only oddity. The τρόχιλοι are replaced by a long passage starting “[Apollodorus] expressly instructs the technician to insert four 54-inch wheels pinned through on stout axles, with cold-work iron plates” (τῷ τεχνίτῃ ἐμφαινῶν ἐντέλλεται τροχοὺς ἐμβάλλειν τέσσαρας ἐξ εὐτόνων ἀξόνων συμπεπερονημένους καὶ σιδηροῖς πετάλλοις ψυχρηλάτοις συνδεδεμένας, τὴν διάμετρον ἔχοντας ἥτοι τὸ ὕψος ποδῶν ὡσεὶ τεσσάρων ἡμισυ), and going on to explain in his pedantic and long-winded manner, and in the accusative and infinitive throughout, how and why the wheels must be bolted internally with iron and fitted two on each side. The manner is unmistakably that of the Byzantine, but the wheels, both in construction and size are imported from a shed designed by Philo whose description is preserved by *Ath. Mech.* 16.14–17.2 (attributed by him to “Philo of Athens”): οἱ δὲ τροχοὶ γίνονται τέσσαρες, τὴν μὲν διάμετρον τριπλήεις, τὸ δὲ πάχος ποδιαῖοι, δεδόμενοι σιδηραῖς λεπίσι ψυχρηλάταις. Athenaeus is following Agesistratus (*Ath. Mech.* 7.6f), who is also the source for *Vitr.* 10.14.1. Unless the Byzantine is lying with a quite uncharacteristic bravura, he must have found these words or something very like them in his text of the *Polioretica*, which was written in uncials and either identical with or very close to the archetype from which all our existing Mss. derive. They may have been a marginal gloss that did not get into the main tradition. Curiously, neither Wescher nor Schneider discusses this passage.

been designed to be.... ” (πρὸς ταῦτα ἐπενοήθησαν) and a suggestion that these ladders be a permanent piece of equipment carried by the forward troops like weapons (176.6f: αὐταὶ καὶ ἀκολουθεῖν δύνανται παρασκευασμένα ὡς περ ὅπλα, οὔτε ὄγκον οὔτε βάρος ἔχουσαι). Before the design can be introduced, however, the editor bursts in with a passionate contradiction, “Rather they are dangerous, and completely subject to the power of the defenders.... ” (ἐπικίνδυνοι δέ εἰσι μᾶλλον, καὶ ὅλαι ἐν τῇ ἐξουσίᾳ τῶν τειχοφυλάκων), which continues for thirteen lines with a catalogue of possible disasters and difficulties in the grand rhetorical manner (175.2–176.1). After that it is somewhat surprising that he allows the original text to resume calmly with its “Therefore..., ” but he reasserts his point of view very quickly as soon as the original design is finished (177.3), and redesigns the whole system to avoid the dangers that he has perceived in the original design, and to lead into the more advanced suggestions that will follow.

Taking these editorial interventions as a whole we may note that interpolations 3–6 all introduce wheels, that 2 and 6 assimilate simplified devices to well-known and more complex models, that 5 refers back to 4, and that 1, 6, and 7 look forward to the introduction of further additions. One editor is responsible for all of them, and he adds a bit of polish to every one of the older devices. He has had good training in rhetoric, but none in technical writing; he is systematic, and refers both backwards and forwards, but is not careful of the order of exposition within a given description. And in items 1 to 6 it looks very much as though, where this text will incorporate the original, he is not writing out or dictating his revised version but altering an existing copy, inserting a word here and there in the middle of a sentence, or a few sentences at the end of a description. That conserves effort and—for us—it also conserves the original because he does not remove items that will conflict with his own additions or rearrange them. It therefore seems very likely that nearly the whole of the original has been reproduced unchanged in the new edition, except perhaps where small interlinear interpolations may have confused the editor’s copyist.

II. Contents

A test for discerning the original material is provided in the introduction by the description of the context of the work and the statement of design principles. The author states (137.10–

138.5) that he intends to assist the emperor and his staff “not only to understand the engines but to use them, because campaigning among tribes and regions that can be upset by quite small chances is a very different matter from besieging cities with a full siege train and plenty of time and materials” (ταῦτά σοι ἐφωδίασα, δέσποτα, ὡς οὐ μόνον ἐπινοεῖν ὑμᾶς τὰ ἔργα ἀλλὰ καὶ χρῆσθαι αὐτοῖς διδάξας· ἄλλως γὰρ πολιορκεῖται πολίσματα πάσῃ παρασκευῇ καὶ ἀφθονίᾳ καὶ ὕλης καὶ χρόνου, καὶ ἄλλως ἔθνη καὶ κλίματα ὑπὸ τῆς τυχούσης περιτροπῆς εὐτροποῦμενα). The devices have been designed so as to be (137.8ff) “effective and structurally and militarily safe, and as far as possible of easily obtainable materials, light, efficient, and capable of speedy construction by anyone available” (ἐκάστω βοήθειαν καὶ φυλακὴν καὶ ἀσφάλειαν προσαρμόσας, καὶ ὡς ἐπὶ τὸ πλεῖστον εὐπόριστα, ἐλαφρὰ, εὐεργῆ, ταχέα ὑπὸ τῶν τυχόντων συντελούμενα).

Now that we have purged the minor interpolations, we can make out a short pamphlet that fulfills these promises, containing short epistolary preface, a list of contents, and descriptions of simple devices for use in besieging fortified and elevated positions. The troops require protection from rolling barrels and wagons as they make their way up a hill, and protection from missiles as they reach the top. Once on top, they try to undermine the walls, or to ram the gates or the corner of a tower. If resistance is strong, they erect a tower of their own at a short distance from the walls, presumably to keep the enemies' heads down and cover their own operations. If resistance is weak, or if they can achieve surprise, the troops will use assault ladders. All these requirements except that for the tower, and no others, are mentioned in the uncorrupted portions of the list of contents, and it is possible that a mention of the tower in the genitive may have been obscured by the writing in of the nominatives. All the devices would be effective, protective, and structurally safe, and all have a main structure that is light, economical of materials, and can be quickly constructed without specialist skills. All the descriptions except the tower are prefaced by a short discussion of the use of the device. Several designs provide an elegant solution to the problem in hand and seem to justify the author's claim in the preface (138.6f) that he has thought them out afresh. One of them is the ram-shed, and two examples depicted on the Arch of Severus make it virtually certain that the new design became

standard in the Roman army.²⁸ Possible representations of two others on Trajan's Column, the deflectors (PLATE 1) and the ladders (PLATE 2), will be discussed below.

On the other hand, it is easy to spot devices that do not obey the design principles and belong to the world of make-believe. The drill (148.1–152.5) is badly designed and underpowered.²⁹ Even if it worked, drilling a continuous line of holes at an angle would be slow and probably ineffective in felling the wall; if effective, it would be suicidal. A brick wall, where the bricks overlap and can settle individually, could only be made to slip sideways by cutting through all the bricks obliquely at a steep angle, but once ready to slip it would not be held back by a few wedges. The proposals for removing the wedges by burning seem not to have convinced even the author.

The flame-thrower that follows the drill (152.6–153.7) is another attempt to apply quarrying techniques to siege warfare and in principle quite practicable. It is reminiscent of the device used to set fire to wooden barricades by the Boeotians after Delium (Thuc. 4.100), but our author does not seem to have read that and his device is so small that it would have little effect.³⁰ In any case, its place is in a siege train. It could not be part of a legion's marching equipment, like the ladders, nor could it be improvised upon the spot.

The elevating reconnaissance-ladder (161.9–164.4) is an interesting exercise in the application of the properties of a paral-

²⁸ Lendle's careful analysis of the virtues of the ram-shed (*Schildkröten* 106f) brings out very well "den fundamentalen Unterschied zwischen seiner [sc. Apollodorus'] Maschinen und den hellenistischen Schildkröten." He notes an analogous difference in the tower (*Texte* 77f). The two representations of the ram-shed are shown in R. Brilliant, *The Arch of Septimius Severus in the Roman Forum* (= *MAAR* 29 [Rome 1967]) Pls. 70a, 74, and well analyzed by Lendle, *Texte* 188–191. The second shed, for the the operators, is larger than the shed holding the ram, whereas that in the text is smaller, but the difference is unimportant. The ram-sheds are not shown with a forward inclination of the gable, but they do have the general triangular shape that distinguishes them from the elaborate designs described at Vit. 10.13.6, 15. (As Lendle showed, the arrangement of the laths indicates the shape, although that is somewhat obscured by damage to the relief.)

²⁹ A bit six-inches wide is riveted to a three-quarters-inch diameter shaft. It is offered with three alternative methods of drive, ἀρίδι στρέφεται ἢ ἀστερίσκοις ἢ χερσίν, of which only the second would supply the necessary torque.

³⁰ Air is supplied to a pot filled with charcoal through a three-quarters-inch nozzle powered by a single ἄσκωμα—a word suggesting something the size of a wineskin. The Boeotian device used φύσας μεγάλας, sets of large bellows.

lelogram.³¹ It is intended to raise the scout suddenly above the wall and withdraw him before he can be shot down. But it requires special timbers that must be both long and very strong, specially strong pivots, and a skilled engineer to construct it, and the value of surprise would be quickly dissipated.

The attachments proposed for the tower (168.1–174.7) and for the ladders (177.4–188.9) are even more unsatisfactory (*cf.* *Figs.* 3–4). Misgivings about the safety of some of the devices seem to be voiced by afterthoughts or glosses, adding guy ropes, or boldly asserting that a disaster that is only too likely will not occur (*e.g.* 164.1–4, 186.1f). There is a bland disregard of the power of reactive forces—in fact of any forces except those which directly fulfill the designer's wishes. Heavy rams are swung from tall structures without disturbing their stability, and, as in Hegetor's design, they are expected to swing upwards without losing energy.³² The enemy who is to be pushed off the wall by a pivoted sweep is given a mechanical advantage of about five to one should he wish instead to push the sweep's operator off the tower. The irresponsibility of these and other designs would be distressing if they were taken seriously, but it is clear that they are put forward not to solve a problem but to display the ingenuity of their authors. Even where there is a genuine problem, it is solved in an unnecessarily complex way. For example the drawbridge (168.1–170.2), when it is upright, requires loopholes through which troops can shoot and which

³¹ A parallelogram is formed in the vertical plane. Two levers of equal length are pivoted [one above the other and] three feet apart between vertical supports. At one end they are pivoted to a vertical ladder on which the scout will be mounted, at the other to a handle that will be pulled down to raise the ladder. Although the words in brackets do not appear in the text, this interpretation is made certain by the distance between the levers, which is much greater than that between the sides of a light ladder, and by the prediction that the ladder will always remain vertical because it is linked to the two of them (162.13f). The design was not understood by the illustrators nor by the author of the *Parangelmata*. Schneider's glaring mistranslation of the second passage was presumably the result of over-reliance on the *Parangelmata*. Lendle (*Texte* 28–35) also follows the *Parangelmata*.

³² *Vitr.* 10.15.7; *cf.* the comment of L. Callebaut and P. Fleury, *Vitruve, de l'Architecture* 10 (Paris 1986) 266. Hegetor of Byzantium is known to us only as the inventor of a giant ram, of which *Ath. Mech.* 21–26 and *Vitr.* 10.15 preserve a bald and in places confusing list of dimensions, followed by a few dubious claims for its performance. Athenaeus' account, which is written in the present tense, is probably nearer to the common source than Vitruvius', which is mainly in the pluperfect. Both are using the same secondary source (*cf.* n.55), but it is possible that Athenaeus, who is scrupulous with his references, also consulted a copy of the original work.

must be covered when it is lowered. A simple hinged shutter would suffice, but instead we are offered a shutter like a venetian blind (169.5–170.2), which the author assures us “can if necessary be drawn back again.”³³ None of the devices has anything that would seriously contribute to the success of a campaign of the type described, and the new uses involve modifications to the basic structures that run counter to the aims of the pamphlet. The drawbridge and rams added to the tower require it to be moved up to the wall on wheels, which will require the bringing up of a skilled engineer and strong axles, while the additions to the ladders involve strengthening the joints with iron and, if the structures are to be stable, an increase in the width of the ladders so that they will lose the lightness that was their chief merit. Similar objections can be made to the alterations of the sheds for mining (146.4–147.6) and of the rams (156.1–157.6).

Finally the floating ‘bridge’ or assault raft (189.1–193.5) swings across the river laden with troops and has ramps along one side by which they will climb up the opposing bank. It is, like the scout-ladder, an interesting exercise in applied geometry, but likely to be very unstable. The author of the Byzantine *De re strategika*, after politely observing that the design may be sound in theory (ἡ μὲν φαντασία τοῦ ἔργου λόγον ἴσως ἔχει), shows comprehensively that the design is misconceived.³⁴

We thus have a fairly clear distinction between a coherent but unglamorous text written for a definite situation (which would be of little general interest, especially when the plans it accompanied had been lost) and an agglomeration of imaginative but impractical contributions attached to the core in groups to provide an illustrated compendium of much wider interest. Different levels of practicality in the work have indeed been

³³ Lendle (*Texte* 89, fig. 24) provides a reconstruction that is indeed very simple, like the rolling out of a rush mat, but at the cost of omitting any means of preventing slippage sideways or backwards. The author, however, seems to be worried by such possibilities, and he may have intended a more complex arrangement.

³⁴ 19.21–55 Dennis (*supra* n.7. I owe this reference to an anonymous referee). The Byzantine notes one advantage of the design, that the raft is at all times fast to the bank at one end or the other, so that it cannot be swept away by the current. Nevertheless, it is better to use boats. His account is clearer than the original but refers to a tower at the upstream end of the raft that does not appear in Apollodorus’ text. The implications of this testimonium for the dating of the interpolations are discussed in n.39 *infra*.

noted before, and Lendle, who believes that such mixtures were an accepted feature of the poliorcetic genre,³⁵ has suggested that it was produced by Apollodorus in his old age, reworking earlier notes.³⁶ But the manner in which the small interpolations have been made, and especially the tone of the attack on scaling ladders, make that exceedingly unlikely, and differences of style rule it out completely. A full description of the style of the original and a comparison with other expository texts requires separate study, but a handy litmus test for detecting even fairly short additions can be provided quite briefly. The core text, in both the preface and the descriptions, is notable for its vigor, careful organization, and tact. The longer descriptions are divided into stages, each covered by a short paragraph that begins by picking up from its predecessor and is rounded off with a conclusion that marks the completion of the stage. Most of each description, whatever its length, is written in the indicative, shifting to the third person imperative to draw attention to important points. The additions, on the other hand, are never articulated into stages, and with the exception of two passages whose spuriousness can be demonstrated on other grounds, never have the same mood pattern.³⁷ Nearly all are written predominantly in the third-person imperative, with indicatives, either present or future, towards the end of a description to describe the operation of the device. Indicatives can also be used for comments, or for variation. One, describing the flame-thrower (152.6–153.7), is written in the indicative throughout and in a tone different from any of the others.

A separation of the text based on these differences is given in the Appendix.

³⁵ *Schildkröten* 123, referring particularly to the impractical designs attributed to famous engineers such as Diades by Athenaeus and Vitruvius. The possibility, however, that Athenaeus and Vitruvius and/or their common source were misled by pseudonymous or interpolated texts or failed to note distinctions that the older authors drew, is too strong to allow such an inference to be drawn.

³⁶ *Texte* xx. He accepts *Parangelmata* 198.1 as addressed to the emperor Hadrian, though he is aware of the Byzantine's limitations (*Texte* xx n.9). Lendle is also more concerned with understanding the devices than with assessing their practicality (*Texte* xvii).

³⁷ Exceptions are the description of the scout-ladder (161.9–164.4), which attempts to imitate the style of the original without the articulation, and a short and rather sensible passage adding cross-braces to the pairs of ladders (187.10–188.2), which uses ὅταν with the future indicative and is probably later than the rest of the text.

III. History of the Text

Apart from one or two late glosses, and perhaps the cross-struts just noted, the most recent stratum in our present text seems to be that containing all but two of the spurious designs together with their illustrations. The references to the illustrations are more or less uniform; there are the occasional cross-references already noted; and alterations have been made in the text of the list of contents, the tower, and the ladders in order to make provision for the new material. One or two of these designs show signs of a different authorship, notably the fire baskets (152.6–153.7) and the cross-braces already noted (187.11–188.2), but the editor may have used several sources. Such an illustrated edition would have been possible in a codex³⁸ at any time from the fourth century onward, in the climate that produced the Latin *De rebus bellicis*.

Two exceptions, the elevating scout-ladders and the raft, may have been added earlier. Each is longer than the rest of the spurious descriptions, and each occupies a similarly detached position in the structure of the book, not being a development of any other device. Each shows some geometrical ingenuity though a serious lack of realism. Their stylistic faults are similar—both are rushed and inadequately planned—and although they differ in their handling of the moods and tenses of the verb, it would be quite possible for a single writer to write both, imitating the authentic passages more closely in one than in the other.³⁹

³⁸ The editor's method of adaptation suggests that he is interleaving the new material with the old. References to illustrations "at the side" (e.g. 185.2: παρακεῖται), "below" (e.g. 186.3: ὑποκεῖται), and "in the text" (153.6: ἐγγέγραπται) would be less likely in a scroll, though not impossible.

³⁹ Some further support for a separate origin for these two passages is provided by the illustrations. We are told that the ladder will be illustrated by formal drawing in plan and elevation (163.3: τό τε κείμενον καὶ τὸ ὠρθωμένον), while a drawing of the raft (191.5: τὸ σχῆμα τὸ ὑποκείμενον) actually is in plan, unlike any other in the book, and we are promised another drawing in elevation (193.1f: ὑπεθέμην καὶ ὡς ὀρθογραφεῖται, ἵνα πρόδηλος ᾗ καὶ ἡ τῆς κλίμακος θέσις καὶ τοῦ προτειχίσματος). None of these drawings, except the ground plan of the raft, has survived, and only the ground plan of the raft corresponds with the text. The illustrations of the elevating ladder in our present text quite misunderstand the design, and the elevation of the raft and its bulwark absurdly takes the 'bulwark' to be that of a fortress that the raft is attacking. These two sections of the text may have appeared two stages earlier

As for the core, we have seen no reason to suppose that anything much was omitted by the redactor, nor—bearing in mind that it was not intended to provide a complete set of instructions for building the devices—for accepting Wescher's suggestion that what we have is a *précis* (*cf. supra* n.17). The vigor of the writing and the excellence of the designs have been noted, and it remains to find a context.

IV. Provenance and Authorship of the Original Work

The *prima facie* evidence for ascribing the work to Apollodorus is of course the title in our Mss., but its form is unusual and we may postpone considering it until we have looked at the work itself.

We may start with the form and content of the preface.

(137) Ἀνέγνων σου, δέσποτα, τὴν περὶ τῶν μηχανημάτων ἐπιστολὴν καὶ μακάριος ἐγενόμην, ὅτι με κοινω- νῆσαι ταύτης σου τῆς φροντίδος ἄξιον ἔκρινας. ποιήσας οὖν ὑποδείγματα τινὰ πρὸς πολιορκίαν εὐχρηστα ἔπεμψα διαγράψας, καὶ πᾶσαν ὑπελάλησα καὶ ὑπουργὸν ἀπέλυσα πάντα δείξας καὶ ἐπ' αὐτοῦ ἐργασάμενος, ἵνα πρὸς τὰ ὑποδείγματα ὁμοίως, εἴ τις χρεῖα γένοιτο, ἐργάσῃται. ἐπεὶ οὖν ἀγνοῶ τοὺς τόπους, σχήματα πολλὰ καὶ ποικίλα διέγραψα καὶ τὰς αἰτίας ἐπήνεγκα, ἐκάστω βοήθειαν καὶ φυλακὴν καὶ ἀσφάλειαν προσαρμόσας, καὶ ὡς ἐπὶ τὸ πλεῖστον εὐπόριστα, ἐλαφρὰ, εὐεργῆ, ταχέως ὑπὸ τῶν τυχόντων συντελούμενα. (138) ταῦτά σοι ἐφωδίασα, δέσποτα, ὡς οὐ μόνον ἐπινοεῖν ὑμᾶς τὰ ἔργα ἀλλὰ καὶ χρῆσθαι αὐτοῖς δύνασθαι διδάξας· ἄλλως γὰρ πόλιορκεῖται πολίσματα πάσῃ παρασκευῇ καὶ ἀφθονίᾳ καὶ ὕλης καὶ χρόνου, καὶ ἄλλως ἔθνη καὶ κλίματα ὑπὸ τῆς τυχούσης περιτροπῆς εὐτροπούμενα. ὅθεν σκεψάμενος καὶ ἐννοηθεὶς ταῦτα, βράδιον ἀν- τέγραψά σοι, οὐδὲν διὰ τὴν καινότητα καὶ τὸ τῆς χρήσεως τάχος ὑπὸ τῶν προγεγενημένων ὠφελῆθῆναι

in the tradition than the current set of illustrations, once with their own illustrations and then in a copy without them, or only one stage earlier, with a promise of illustrations that was not fulfilled. The only other reference to formal plans or elevations, as opposed to undifferentiated σχήματα occurs at the end of the description of the ram-shed (156.1f), τὰ δὲ σχήματα καὶ τὰ ὄρθια (καὶ) τὰ κάτω γεγραμμένα παράκειται, and here too the illustrations are not in plan and elevation as described but in perspective (σκηνογραφία).

δυνηθείς. ἔπεμψα δὲ καὶ τέκτονας ἐγχωρίους⁴⁰ καὶ τοὺς ἄλλως ἐργάσασθαι καὶ ποιῆσαι δυναμένους. οἶδα γὰρ μετὰ σου ἐν ταῖς παρατάξεσι γενόμενος, ὅτε εὐτύχουν στρατιωτῶν εὐπορήσας πρὸς τὸ καλῶς ἐργάσασθαι ἢ συνηθεία ἢ εὐχερεία, οἶον αἰ ἐν τοῖς πολέμοις ἐκ τοῦ παραδόξου χρεῖαι ὡς εὐστρόφων καὶ ἀνθρώπων καὶ μηχανημάτων δέονται. ἐὰν δὲ τι ἐν τοῖς ἐπὶ ἐκάστου συστήματος ἐπιλογισμοῖς ἀσαφῶς εἶπω, σύγγνωθι, δέσποτα. καὶ γὰρ τὰ ὀνόματα τῆς ἐπιστήμης ἀσυνήθη ἔσται τοῖς κοινοῖς λόγοις, καὶ ποικίλην θεωρίαν ἔχει τὸ ἔργον, καὶ αὐτὸς ἐγὼ εἰπεῖν τάχα ἀσθενέστερος· τάχα δὲ ἡ μεγαλοφυΐα σου διορθοῦται, καὶ συγγινώσκει ἡ εὐμένεια.

(137) I have read your letter on military engineering, my lord, and am honored that you judge me worthy to share your thinking on this matter. I have accordingly made some sketches⁴¹ [of things that will be] useful for sieges, drawn them out and sent the drawing. I have added a verbal description to each, and manumitted a member of my staff, having shown him everything and constructed it in his presence, so that he can work according to the design if required. Not knowing the places where they will be needed, I have illustrated many different arrangements and set out the reasons for them, ensuring that each will be effective, protective, and safe, and that as far as possible all shall be made of easily provided materials, light in weight, well engineered and quick to produce with unskilled labor.

(138) I have supplied you with these, my lord, to help you not only to understand the engines but to use them, for it is one thing to lay siege to cities with a full siege train and an abundance of both time and materials, and quite another (*sc.* to operate among) tribes and regions that can change sides as the result of a single setback. And that is why I have taken some time to reply. I have looked into the problem and devised ways of dealing with it, without being able to get help from previous writers because of the novelty of the problem

⁴⁰ ἐγχωρίους VP. Schneider's conjecture ἐγχωρητικούς, ("handy") is strained. A possible explanation for the present text is suggested below: *cf.* n.42.

⁴¹ Or possibly "models"; *cf.* the discussion of the dangers of working from small-scale models (παραδείγματα), Ath. Mech. 28.9–29.1. The details of working practice are irrelevant to the main point of the letter and the author's reasons for introducing them here will be discussed below.

and the need for speed. I have also sent some local carpenters and men who are in other ways good at making and doing things, because from my experience with you on your campaigns, when I was fortunate enough to be well supplied with soldiers equipped for good workmanship either by experience or natural handiness, I know how great are the needs that arise unexpectedly in war for versatile men and instruments.

If there is anything unclear in the description of a particular structure, please, my lord, excuse me. The scientific terms are unfamiliar in common speech, the theory has many aspects, and I am perhaps rather weak with words. But perhaps your great ability will amend the fault, and your kindness pardon it.

Conventional epistolary introductions are frequent in Hellenistic writing, in technical as in other genres.⁴² This could in principle be another example, but if so, it is unusually fulsome. The 'letter' is accompanied by an unsolicited gift as well as the designs requested, and the recipient is referred to no less than ten times in second-person singular verbs and pronouns or vocatives, with a further pronoun in the second person plural to include his staff. And the letter includes also an unusually large number of background items, building up a picture of a relationship between writer and addressee. They may be summarized as follows:

- (1) An unnamed emperor has been thinking about devices for siege warfare, and has written to consult the author about them and request some designs (137.1ff).
- (2) The author, though he has served in the army (no. 8 below), is now in civil practice and has a drawing office staffed by slaves (137.5).
- (3) The devices are required for a particular campaign. The territory is unfamiliar to the writer, but he believes that the inhabitants are politically unstable and easily influenced by immediate success or failure, and has accordingly made his devices as economical, light, efficient, and easily constructed as he can (137.7, 138.4f).
- (4) The author suspects that the emperor and/or his staff (138.1: ὑμᾶς) have hitherto been planning their strategy in terms of set

⁴² Cf. P. M. Fraser, *Ptolemaic Alexandria* (Oxford 1972) I 428; T. Janson, *Latin Prose Prefaces* (Stockholm 1964) 19–22.

piece attacks by a full siege train, and that he needs to help them reassess the function as well as the construction of siege devices in campaigns of this type (138.1–5).

(5) Operations as rapid as this are not covered by the existing technical manuals (138.5ff).

(6) The campaign is still some way in the future, and the author has taken his time (138.5f).

(7) The author writes from an area—very possibly Syria⁴³—that produces good and adaptable slave craftsmen (138.8).

(8) The author has previously seen military action “beside” the emperor, not under his command—and so at a time before the emperor’s accession. At that time the writer had command of a good number of intelligent troops experienced in engineering works (138.9ff).

(9) The writer is personally known to the emperor and aware of his personal good will towards him (138.17).

That the ‘emperor’ here addressed is a real person, and that he really is being addressed, is guaranteed above all by an omission between items 1 and 2. It seems to have been a rule in official correspondence that a query or request should be recapitulated when replying, in sufficient detail to allow its substance to be recalled or reconstructed. Of the 121 letters in the tenth book of Pliny, fifty-two letters (three from Pliny, forty-nine from Trajan) include replies; all but two follow the rule and each of the exceptions may be deliberate.⁴⁴ Anyone writing a fictional letter as an introduction to a manual would be bound to observe that convention, not only because it was the norm, but because the ideas on siege warfare that are attributed to the emperor and his staff in item 4, and that it is the aim of the manual to challenge, could be stated directly at the outset. Instead, they are only hinted at, and even the hint is softened by the unusual ordering of the paragraphs, which as we have already noted puts

⁴³ Cf. R. Delbrück, *Hellenistischen Bauten in Laium* II (Strassburg 1912) 179f.

⁴⁴ The exceptions are Plin. *Ep.* 10.76, 111. In 10.76 no record is needed because Trajan is referring a decision back to Pliny, as he often did. A detailed reply would have involved a reference to Pliny’s personal benefit from the bequest concerned. *Ep.* 10.111 is a reply to 110, in which Pliny requests advice on a case where a leading citizen has been prosecuted for accepting an honorarium many years before Trajan made that illegal. Trajan summarizes the problem, but does not mention the individual or city involved. Since his ruling is that all such prosecutions are against the public interest, the name of the innocent individual does not matter, and least said soonest mended.

the production and despatch of the designs (item 2) before the reasoning on which the designs are based. That can only be because the introduction is a real letter to a real emperor, to whom the implications of item 4 will be unwelcome and embarrassing.

This embarrassment is worth exploring. It is perfectly normal for an independent consultant to challenge the assumptions made by his patron and his patron's staff, and that is often the main point in employing him. Because in this case his challenge causes embarrassment, our author must have been called in, as again often happens, because the in-house opinion is divided, and the assumption that he is challenging must be that made by the person who has called him in. Bluntly, the emperor is unsatisfied with his staff engineers;⁴⁵ he has called in our author to support him or supply something that the staff cannot, but the author refuses. His designs, although introduced by οὖν (item 2), are based not on the emperor's view of the requirements, but on his own. He therefore avoids restating the emperor's request, and delays breaking the bad news until he has established a favorable atmosphere with an account of his vigorous response and a statement of the general principles of military engineering. As soon as the deed is done, he hastens to add some consoling remarks about the difficulty of the problem and then passes to happier topics.

Who then is the emperor and when did he write to our author? Item 8 indicates that the emperor had seen active military service before his accession. Since he is also contemplating further military action, and probably living in the first or second century, he must be either Trajan, whose military service as a young man is not specifically recorded but referred to as *stipendia decem* by Pliny,⁴⁶ or Hadrian, who served in the Dacian Wars, or just possibly Septimius Severus. For what it is worth, the author of the Byzantine *Parangelmata Poliorketika* (198.1) favors Hadrian. But no one who had experienced the small-scale sieges depicted on Trajan's Column would have needed the admonition in item 4 or indeed a new set of devices

⁴⁵ This is the important point made by Sander (457). Lammert's suggestions (1938A: 393) that the emperor is Hadrian, that the author is Apollodorus at the height of his reputation, and that a request for advice is therefore quite natural, would be more convincing were it not so obviously made ad hoc, without consideration of the difficulties of such a dating raised by T. Reinach, "A qui sont dédiées les Poliorkétiques d' Apollodore?" *REG* 8 (1895) 198–202.

⁴⁶ *Pan.* 15.3; cf. R. Syme, *Tacitus* (Oxford 1958) I 31 n.4.

for attacking hill-forts.⁴⁷ The only one of our three emperors who might have needed either would be Trajan between 98 and 101, when his thinking on siege warfare may still have been dominated by the great sieges in Judaea from 67 to 73. He may have seen some of them—perhaps in 67 when his father commanded the Legio X Fretensis and he took the *toga virilis*,⁴⁸ or at the sack of Jerusalem when that legion distinguished itself by its performance with heavy catapults (Jos. *BJ* 5.269f), or even at Masada, where the legion was still involved and would have provided a useful point of attachment for a *tribunus laticlavus*. He will certainly have heard about them from his father and his father's old comrades when he was on his father's staff in Syria in 75, and will have read the vivid accounts of Josephus, which began to appear in that year and continued until 79. It would be entirely understandable if, on the eve of the first great military exploit that was to reward years of personal preparation he should have hoped that the campaign would culminate in a great siege, setting him beside the admired and still regretted Titus.⁴⁹ Sarmizegethusa might be his Jerusalem. It is also very possible that twenty-seven years after Masada and in a quite different theater of war he would not find anyone on his staff who had experience of large siege engines or indeed much enthusiasm for them. The situation would then fit exactly that implied by items 1 and 4.

This hypothesis may be tested by comparing the recommendations in our pamphlet with the scenes on Trajan's Column. The artist who drew the cartoons for these scenes mistook the alignment of struts in the superstructure of the Danube bridge, so he can hardly have been a competent engineer,⁵⁰ but it is generally accepted that he drew heavily on Trajan's account in the *Dacica*.⁵¹ If Trajan had adopted one of the devices recommended by our author he might well have found its success or failure worth mentioning, and the artist would probably have

⁴⁷ This rules out the solution of Reinach (*supra* n.44), who convincingly eliminates Hadrian on other grounds and settles for Trajan, but (accepting the floating bridge) takes the expedition to be that against Parthia.

⁴⁸ Syme (*supra* n.45). Trajan would then have been about fifteen. Military service for a man of his rank could begin as young as fourteen (*HA, Had.* 2.1).

⁴⁹ Admiration in the army for Titus' behavior at Jerusalem: Suet. *Tit.* 5; affectionate memory: Suet. *Tit.* 1 and *passim*.

⁵⁰ Cichorius XCIX, casts 260f; *cf.* Lepper and Frere 150. They note (120) that the artist's ignorance of military engineering has to be taken into account in interpreting several scenes.

⁵¹ Lepper and Frere 226–29 and *passim*.

based an illustration on his description. On the other hand, if Trajan adopted none of them, the pamphlet would have failed in its object and it is difficult to see why it should have survived. We therefore need to look both at similarities and at differences between the pamphlet and the monuments, and also to determine whether any of the similarities relates to a genuinely innovative aspect of the design.

One major difference between the Column and our text is that our author does not expect the enemy to have catapults. The Dacians had in fact captured some after the defeat of Fuscus in 86, and they are shown on the Column putting them to good use in the first war when the Romans attack one of their forts.⁵² So far from being able to erect a light tower close to the walls, the Romans have to put their own artillery into a heavily fortified pillbox. They would also be unable to bring up a ram. The light screen too would be useless, though we are shown a *testudo* of shields used against a smaller fort (LXXI). This discrepancy between our text and the actuality of the First Dacian War is admittedly a difficulty. Surrender of the catapults was demanded as part of the peace terms in 103 (Dio 68.5.9) and seems to have taken place because they are not seen in later episodes on the Column, but by that time Trajan would not need the advice in the introduction to our pamphlet. It is quite possible, however, that at the earlier date our author did not know of the capture of the catapults or foresee how effectively they would be deployed; and although Trajan must have known about them, it does not follow that he would reject the advice. Granted that stone fortifications defended by catapults could not be stormed without siege engines, the author's arguments against trying to deploy such engines and waiting for them to come up would hold whether the enemy had catapults or not. Trajan may quite well have accepted the designs for use where possible, and accepted that really strong fortifications would have to be taken by treachery or blockade, as seems to have happened in the final siege.⁵³ Nevertheless, this constraint on the demand for siege engines will limit the correspondences. Because there are no towers or ram-sheds, it is impossible to test the main feature of the larger designs, *i.e.*, that they can be built very simply and of easily available material. We are left with the ladders and the triangular obstructions.

⁵² Dio 68.9.3–6; *cf.* Cichorius LXVI, 165–69 with commentary in Lepper and Frere 105–08.

⁵³ Cichorius CXI–CXXII, casts 294–332; *cf.* Lepper and Frere 168ff.

The ladders are described as light, twelve feet long, and made of specially chosen timber, intended to be carried as standard equipment (176.1–7: ὡσπερ ὄπλα). A system of joints allows them to be combined to reach a height of forty feet or possibly more: each section is pinned to the next by dowels of wood or metal that replace the two rungs at the end of each ladder (176.8–177.3). On the Column three ladders are shown in use. The artist appears to have drawn attention to their lightness by showing one being carried by a single soldier (PLATE 2),⁵⁴ and on the outer side of the right-hand upright of that ladder there is a small projecting knob level with the top rung. It looks very like the head of a pin or dowel, and although there is only one where we should expect two, it is difficult to see any other reason for its being there.

The triangular objects in PLATE 1, which have been identified by Lendle⁵⁵ with the devices for deflecting rolling barrels in our text (140.9–141.5), are also fairly convincing. Those in the text have the same function as the τρίβολοι to which Athenaeus *Mechanicus* (38.2ff) refers without further description, but they are introduced here as something new and more elaborate. First their general shape is described as “the tortoise shaped like a (ship’s) beak” (ἡ δὲ χελώνη ἐμβόλου σχῆμα ἔχουσα), in which the definite article seems to be a reference (the only one in the work) to the plans provided. There follow the method of moving them and the reference to pegs already examined (*supra* n.18) and reference to a further reinforcement: “It shall have also a diagonal strut in the opening (*sc.* between the two sides) propping it up to prevent overturning” (ἔξει δὲ καὶ πλάγιον ξύλον τὸ μέτωπον αὐτῆς κατὰ τὴν ὑποστροφὴν ἐρεΐδον). Just such a strut can be seen in the triangular structures in PLATE 1, together with a set of pegs. Moreover, the relationship with the barrels, which is carefully analysed by Lendle, renders very plausible the suggestion that the obstacles are preventing the barrels from rolling down onto the Romans beneath. There is, however, a difficulty: the wheels, which we removed from the text (*supra* n.20), seem to have cropped up again. That causes difficulty not just in connecting the devices with our text but in

⁵⁴ The other two (Cichorius CXIII, casts 302–03) show respectively the exposure of a ladder to a heavy stone thrown by a defender, and the success of one of the attackers in mounting a ladder and beheading a defender in an attack that is finally unsuccessful.

⁵⁵ *Texte* 184–87. For the many other explanations offered, see Lepper and Frere 165ff. None takes account of our text or has gained general acceptance.

identifying them as obstacles. Wheels obviously make them harder to immobilize, but do not add to the ease of moving them into position because the hill is too steep. The obstacles ought to be sledges, like those described in the original text of the *Poliorcetica*.

Is it possible that these wheels too are an addition? Lendle, who accepts the iron wheels in 140.11, thinks (*Texte* 187) those on the Column too large. They are "bei weitem zu groß geraten, was dazu geführt hat, daß die für die Funktion des Gerätes wesentlich Spitze scheinbar durch ein Rad ersetzt ist." Furthermore, they are very poorly drawn:

die Räder sitzen teils innerhalb, teils außerdem des Balkendreiecks, das insgesamt nicht korrekt wiedergegeben ist; die Stacheln, mit deren Hilfe wohl das schräge Stützholz im Boden verankert wurde bzw. die Pflöcke, die hinter der Rückseite der Maschine eingeschlagen wurden, scheinen aus der Achse des unteren Räderpaares hervorzuragen: am oberen Ende dieser scheinbaren Achse sind sichelartige Ansätze eingezeichnet, hinter denen wohl ebenfalls derartige Haltepflocke zu vermuten sind.

It therefore seems likely that the artist who drew the cartoons for the sculptor was working not from a drawing, or visual memory, but from a written description. That he has misunderstood that description in some way or other is suggested by the difficulty of interpreting his illustration; misunderstanding is also inherently quite probable in view of his ignorance of military engineering. All that would be necessary would be the association of some word used to describe the device—*testudo*, say, or *χελώνη*—in the mind of the artist who drew the cartoon of an engine on wheels like the classic designs in the literature.

Taking these correspondences as a whole, and bearing in mind the rarity of siege engines on ancient monuments and the inaccuracy of the Column where military engineering is concerned, it seems fair to say that they do not exclude a date for the original letter at the time of the First Dacian War and render a date before the beginning of the second war rather more probable than any other.

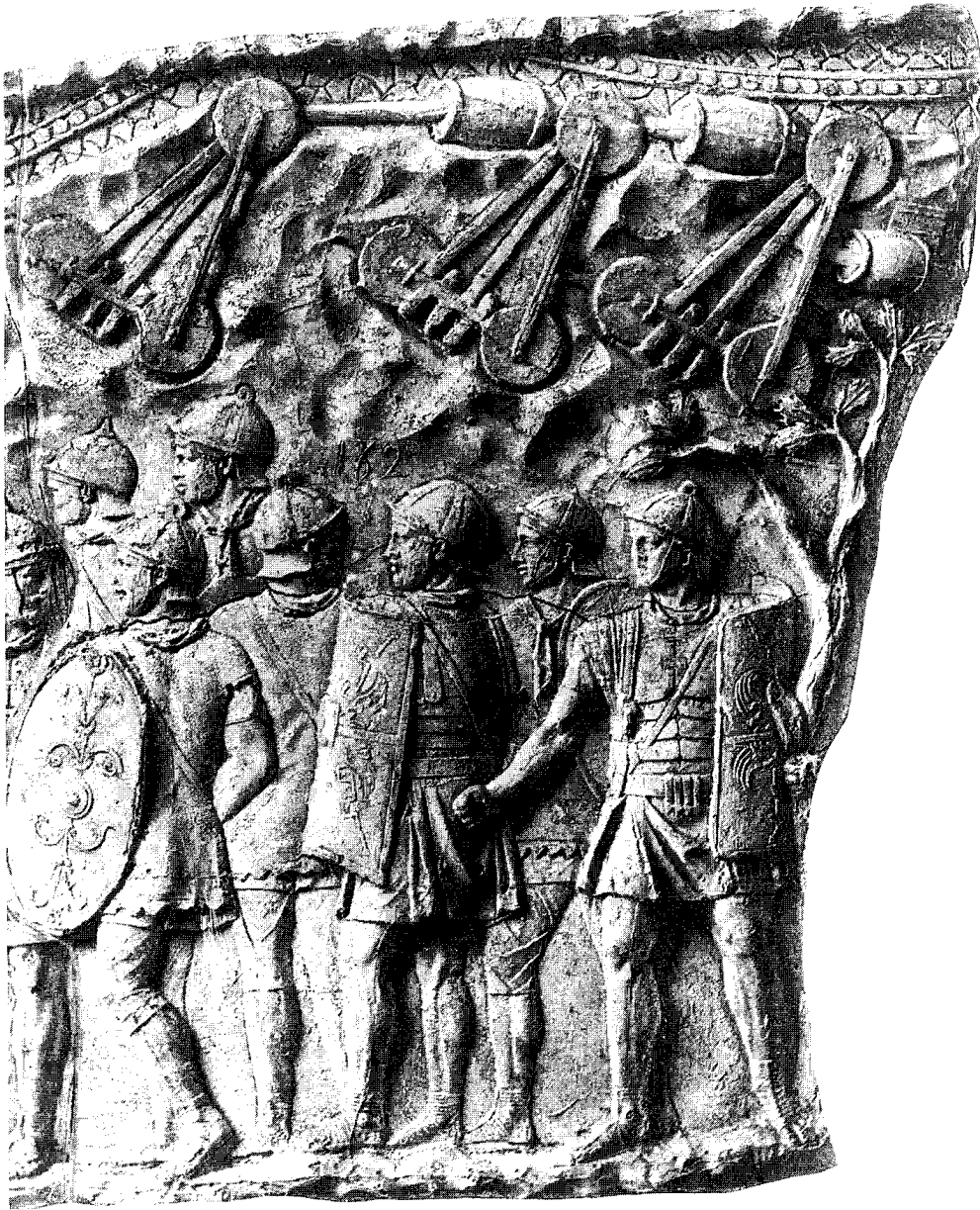
Turning to the identity of the author, we note that he writes with considerable authority. He knows the literature but does not rely on it. That is rare among *poliorcetic* writers of the Empire. Following the policy of Augustus, *coercendi intra terminos imperii* (Tac. *Ann.* 1.11.7), there were few opportunities

for siege warfare for many years. The subject had become academic and was taught by the study of literary texts.⁵⁶ No doubt the contrast between the grand style described in the manuals and what actually happened in border areas became something of a commonplace among serving officers, especially in the West. But in the East, in the sixties, things changed dramatically. The campaigns of Corbulo in Armenia (56–63), where fortresses were captured in a single day and large towns fell to a speedy follow-up, demanded exactly the rapid deployment envisaged by our author. The contrast between this and the Jewish War that followed would have struck any engineer based in Syria at the time, whether he was on the general's staff or attached to a legion such as the X Fretensis. Such a man would therefore be very likely to make the point in item 4, and it is easy to construct a career that would fit the other items—a post commanding or supervising a substantial number of troops and a meeting with the emperor in the years of the latter's military service (item 8), retirement and private practice in the provinces (item 7), and continuing contact with the emperor (items 1, 9). So for the author, too, a date somewhere between 80 and 110 fits the references better than any other.

The author was therefore a contemporary of Apollodorus of Damascus, probably his fellow-countryman, and twenty to forty years his senior. If he had held a position of responsibility in 67, which seems likely, and wrote the letter in 100, he would by then have been somewhere between fifty-four and seventy-four. Apollodorus, on the other hand, was probably not much more than thirty-five. He designed the Danube bridge in 105/106 and Trajan's Forum and adjacent buildings in 107–113 (Procop. *Aed.* 4.6.11–15); the date of his death was variously reckoned as 125 or 129.⁵⁷ That he was by then a venerable but still highly productive octogenarian, like Sophocles or Michaelangelo, is conceivable but unlikely, because our sources would have found the added pathos too good to miss; they are reporting his death as a reproach to Hadrian. A further hint that

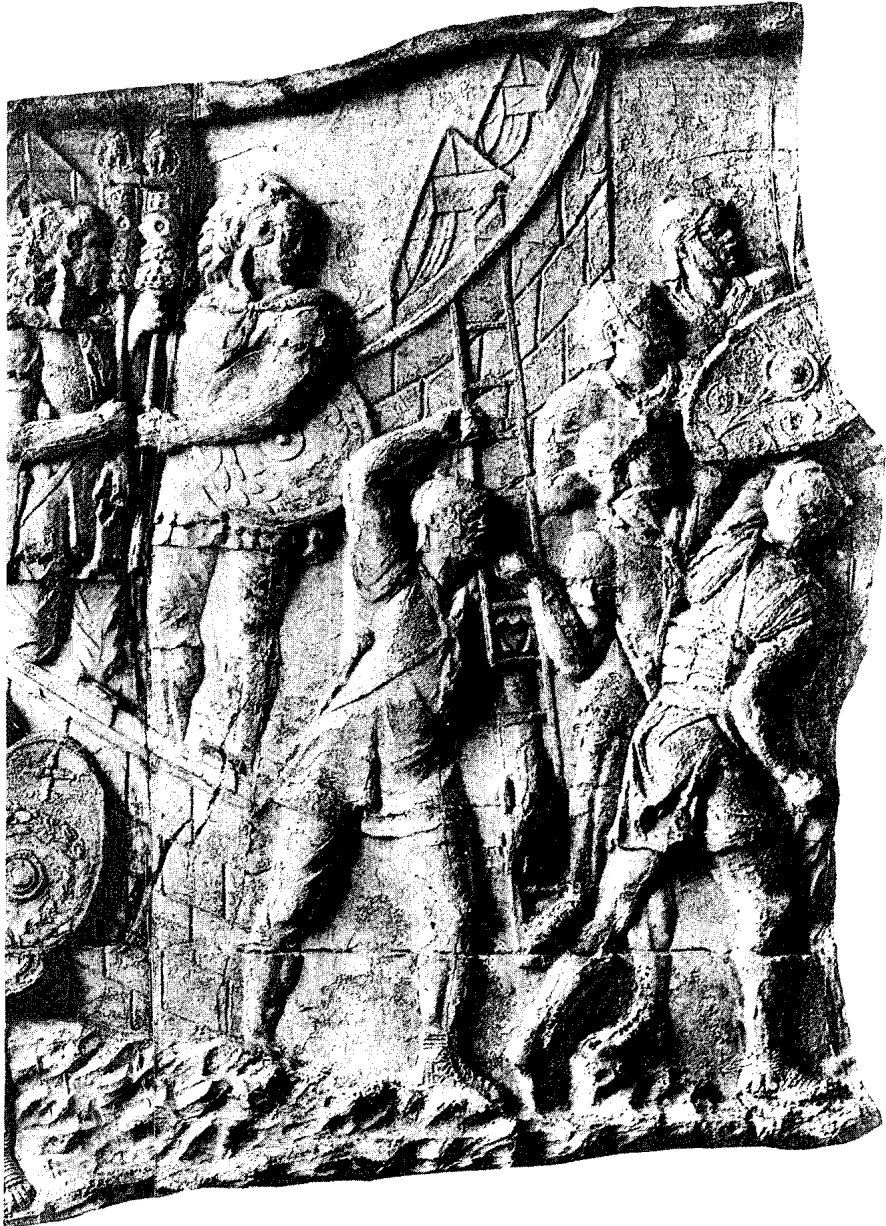
⁵⁶ Cf. Vitruv. 10.13–16. Lendle suggests that this text of Vitruvius is based on a series of lectures that were also attended by Athenaeus: see his "Vitruv als Übersetzer," in C. W. Müller, K. Sier, and J. Werner, edd., *Zum Umgang mit fremden Sprachen in der griechisch-römischen Antike: Kolloquium der Fachrichtungen klassische Philologie der Universitäten Leipzig und Saarbrücken, November 1989* (Stuttgart 1992) 189–200.

⁵⁷ The earlier date is given by Reinach (*supra* n.44), the latter by H. W. Richmond and R. E. Wycherley, "Apollodorus (7)," *OCD*² (1970) 83.



Column of Trajan, detail of Scene CXIV
(Photograph, after C. Cichorius, *Die Reliefs der Trajanssäule*,
courtesy Ashmolean Musum, Oxford)

PLATE 2 BLYTH



Column of Trajan, detail of Scene CXIII
(Photograph, after Cichorius, courtesy Ashmolean Museum)

the work was not written by the historical Apollodorus but had in some way belonged to him as a possession may be implied by the title in our MSS., since ἐκ τῶν Ἀπολλοδώρου ought to mean something different from the simple Ἀπολλοδώρου.

Any lingering desire to attribute the work to Apollodorus, however, is extinguished by yet another subtext in this very complex introduction. The author gives no hint that he would be prepared to join the emperor on his campaign, and he has in fact a quite different plan. He is sending a talented assistant, equipped with his own team of workmen. The party is carefully camouflaged, the leader being presented as a demonstrator and the rest as a gift to the emperor, introduced at a different point in the letter; but the author's intention is clear. The assistant is not to be sidelined: if he lives up to expectation, he should get a position on the emperor's staff fairly quickly, especially as the emperor's other engineers seem to be out of favor; if he fails, it is most unlikely that the emperor will call for his master. The author has done all that could be expected of him and got out of a difficult situation.

How then was the letter preserved? It is unlikely that the author published it, and although copies may have circulated in the army at first, they would quickly have become obsolete as those innovations that worked became part of general practice and any that did not were abandoned. The person most likely to have thought the letter worth preserving would have been the assistant. If he remained a minor figure, or died young, he might quite well have bequeathed his papers to a better-known figure like Apollodorus, whom he must have known, and under whom he may well have worked later. But he may himself have been Apollodorus, owing his training to our author, his advancement (at a time when Trajan may have been dissatisfied with his regular engineers) to the introduction provided in this letter, and his citizenship of Damascus either to some circumstance of his manumission or to a later grant or purchase. In either case, we have a credible chain of transmission for a document that played a part in the planning of an historical campaign, and a brief insight into the training and background of a practical engineer.

APPENDIX

I. Genuine Passages

(1) The introduction and the list of contents, and devices used in climbing the hill, approaching the wall, and undermining the wall (137.1–146.2), omitting the deletions from the list of contents (delendum 1 below), 142.5, γίνονται–σχῆμα, 143.5 (delendum 2), and the gloss 145.12, ἐὰν–περιεσπαρμένα, 146.2 (delendum 3).

(2) The ram-shed and the first description of the ram, 153.8–159.8, omitting 156.1, τὰ δὲ σχήματα–δεήσει, 157.6 and the wheels at 153.9 and 155.9 (delendum 6) and 154.7, βάλλονται–διαφθείρη, 154.11 (delendum 7).

(3) The tower, 164.5–167.9, omitting ὑποτρόχους (164.7) and 165.16, τοσοῦτον–καταπησσομένοις, 166.16 (delendum 10).

(4) The sectional ladders, 175.2–177.3, omitting 175.4, καὶ ὄλαι–βοηθείας, 176.1 (delendum 12).

II. Spurious Passages

(1) Items in the list of contents in the nominative: 139.1, ἐπιβάθρα–ἔνδον, 139.2, and 139.3, διορυγαὶ–ὄχλων, 139.4, and an extension of the list of qualities required, 139.7, εὐδιόρθωτα–εὐλυτα, 139.8.

(2) An alteration of the hand-held screen assimilating it to a ‘tortoise’ or shed, 142.5, γίνονται–σχῆμα, 143.5.

(3) A short gloss at the end of the description of the mined wall, suggesting treatment in case the props do not catch fire, 145.12, ἐὰν–περιεσπαρμένα, 146.2; *cf.* no. 5 below.

(4) An addition to the mining shed, adding a clay covering to the roof and wheels, 146.4, τούτοις–προσφερέσθωσαν, 147.6; *cf.* no. 6 below.

(5) The drill, with instructions for its use, and the flame-thrower, 148.1, ἐὰν–μολιβδουργοί, 153.7.

(6) Interpolations putting a clay roof and wheels on the ‘tortoise’ or shed for the ram, 153.9 ὑποτρόχους, 155.9 τροχίσκους, (possibly 155.9, τὸ δὲ κένωμα–χελώνην, 155.10), 156.1, τὰ δὲ σχήματα–δεήσει, 157.6.

(7) A short gloss on types of missiles hurled from the wall onto rams, 154.7, βάλλονται–διαφθείρη, 154.11.

(8) Additional types of ram-suspension (by more than one hand), 159.11, οὐθεν δὲ ἥσσον–ξύλον, 161.8.

(9) The elevating ladder for spying over enemy walls, 161.9, ἐὰν δὲ βουλώμεθα–τὸ ἔργον, 164.4.

(10) Interpolations adding wheels and guy ropes to the tower and making the sides slope inwards, 164.7 ὑποτρόχους, and probably 164.6f ἀφεστῶτας ὥστε βάρη ἐπ' αὐτοὺς μὴ πίπτειν, 165.16, τοσοῦτον-καταπησομένοις, 166.16.

(11) Additions to the tower, providing drawbridge with roller-blind footway, high-level ram for use against battlements and adaptable for use as scaling ladder, sweep for knocking enemy off wall, alternative foundation for sloping ground, and fire hoses. 168.1 τοῦ πύργου-τόπον 174.7.

(12) Objection that ladders are exposed to danger, 175.3, ἐπικίνδυνοι-βοηθείας, 176.1.

(13) Additions to the sectional ladders, providing metal-bound joints; frame for erection; base and ropes allowing the ladders to be lowered onto the wall with troops already mounted and pulled back in case of difficulty; falling knife for slicing enemies in half; attachment for sprinkling enemy with boiling water or oil; arrangements of ladders in pairs to support rams, one of which is equipped with sprung flail. 177.4, σὺν τῷ κάμακι-ἄλωσιν, 188.9.

(14) Floating assault-bridge, 189.1, πῶς ἄν-συνέρχεται, 193.5.

(15) All the drawings and references to them.

III. The Grammar of the List of Contents

The received text reads as follows:⁵⁸

(138.18) Χρεῖα ἐστὶ μηχανήματων εἰς πολιορκίαν τουτῶν· χελωνῶν κριοφόρων, χελωνῶν διορυκτρίδων, χελωνῶν πρὸς τὰ κυλιόμενα (139.1) βάρη, κριῶν εἶδη εὐπορίστων, ἐπιβάθρα, κριώματα, φυλακὴ πρὸς τὰ ἐπαιρόμενα, σκοποὶ εἰς καταθεώρησιν τῶν ἔνδον, κλιμάκων εὐπορίστων, διορυγαὶ τειχῶν διαφόρων διάφοροι, διαβάσεις ἐπὶ τειχῶν ἀθρόαι ὑπὸ πολλῶν ὄχλων.

There is need of devices for siege work as follows: of ram-bearing sheds, of tunnelling sheds, of sheds against rolling weights, types of easily provided rams; gangways, small (?) rams, protection against things raised up, observation posts for seeing what is inside; of easily-provided ladders; massed crossings by large groups over walls.

⁵⁸ 138.18–139.4, preserving Wescher's line division for ease of reference. MF are missing, but VP agree completely.

The asyndeton is three-fold, switching from the genitive to the nominative at εἶδη back to the genitive at κλιμάκων, and then again to the nominative at διαβάσεις.

Wescher accepted the anacoluthon, remarking merely (*ad* 139.1): “notanda confusio nominativi et genitivi post χρεία ἐστὶ. Quae confusio casuum, quam Graeci ἀνακόλουθον vocant, occurrit etiam in codice B.” But there it is not nearly so harsh. The list in the paraphrase has been expanded to accommodate further items and its order rearranged to group the genitives together at the beginning, followed by all the new material in the nominative. That leaves a single asyndeton, which reads reasonably naturally, as if the genitives had become tedious because of the distance from the introductory phrase. It is clear that the triple asyndeton was felt to be unpleasant.⁵⁹

THAME, OXON.
December, 1992

⁵⁹ I am grateful to the referees of successive drafts of this paper for suggestions and criticisms that have greatly improved it. The views and remaining errors are my own.